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1971 PNW ANNUAL REPORT

PACIFIC NORTHWEST FOREST AND RANGE EXPERIMENT STATION
U.S. DEPARTMENT OF AGRICULTURE / FOREST SERVICE · PORTLAND, OREGON · 1972

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WE WANT A DIALOG–

The 1971 Annual Report highlights our research contribution toward technological underpinning for improved forestry. This underpinning is more important than ever because the demands on forest land are also more intensive and competitive. It is apparent that we must find improved mechanisms for research in order to attack more effectively forestry problems of today. It is also apparent that we must find better ways to tell the forestry story to those who must use the information.

Research Organization

The problems of forestry today concern not so much the lack of knowledge about single uses and single commodities; they concern not fully understanding the interrelationships of multiple uses—water and recreation or timber, wildlife, and livestock. We are now organizing research to attack these problems more effectively.

The first such organization was created in 1971 when four projects at Fairbanks, Alaska, were consolidated into a single interdisciplinary team under the direction of Dr. Charles Cushwa. This team will study the ecology of forests of interior Alaska with the aim of avoiding the consequences of disturbance of many kinds on watersheds, forests, soil, and associated streams. Still another organization is the Coniferous Biome Study for the western States of the International Biological Program. This is a major cooperative effort between Oregon State University, the University of Washington, and the Forest Service to understand better how western coniferous forests function. The aim here too is to predict the consequences of alternative management practices on productivity of the forests. Dr. Jerry Franklin, of the PNW Station, is Deputy Director of the western Coniferous Biome Study.

Another Station multidisciplinary study is the Forest Residues Reduction Program under the direction of John Pierovich. This program has the aim of reducing and otherwise using natural and man-caused forest residues in the Pacific Northwest. This research involves pilot demonstration, development, and extension so that new practices can be translated quickly into use.

And still another major research and development program is Project FALCON (*F*orestry, *A*dvanced *L*ogging and *Con*servation) which was jointly assigned the PNW Station and Region 6. Detailed planning for this program is proceeding under the direction of Dr. Don Flora and Edward Clarke. Involved in FALCON is the search for new and improved timber harvesting methods, including use of helicopters, balloons, and cable systems, to reduce environmental impacts. FALCON is starting in the Pacific Northwest, but the techniques will be applied wherever appropriate throughout the Nation.

All these changes are intended to provide a more effective attack on the large complex problems of modern-day forestry. These new or reoriented research groups will profoundly affect the kinds and quality of research results reported in subsequent years.

Making Results More Available

Methods must be found to translate new knowledge into forestry practice. This process, sometimes called technology transfer, needs to be sharpened and tailored to the specific needs of users. We now have under preparation, major summary publications which will draw existing information together. These summaries will also provide a point of departure for new research. The popular media must also be used more effectively in order to get the scientific story of forestry across.

In addition, we must find better ways to tailor specific scientific findings to the needs of users and public and private land managers. One device that could improve this dialog would be cooperation in preparation of brochures, papers, slide talks, management guides, and films. We will have more to report about technology transfer processes in ensuing years.

Changes in Staff

Philip A. Briegleb, Director of the Station for the last 8 years, retired May 31. His distinguished career in forestry included Directorship of three Forest Experiment Stations and Presidency of the Society of American Foresters. Briegleb had been an employee of the Forest Service for more than 40 years, starting as a junior forester at the Pacific Northwest Station he later was to direct.

I became Director of the Pacific Northwest Station in June 1971. My Forest Service career included 10 years in silvicultural research of northern conifers at Grand Rapids, Minnesota, and 6 years in Washington, D.C., in a variety of assignments, the most recent of which was assistant to the Deputy Chief for Research.

Dr. Robert M. Romancier joined the staff as an Assistant Director. He heads forestry research in the Timber and Watershed Management Research Division, replacing David Tackle, who was transferred to the Washington, D.C., headquarters of the Forest Service in September 1971.

Romancier comes to Portland from the Washington, D.C., Forest Service headquarters, where he was Assistant Chief for Conifer Ecology and Management Research in the Division of Timber Management Research. Tackle is the new Chief for Conifer Ecology and Management Research in Washington, D.C.

Robert W. Harris, formerly Assistant Director, Division of Forest Environment Research, was appointed Director of the Intermountain Forest and Range Experiment Station at Ogden, Utah, and began his new duties on July 8, 1971. Robert F. Tarrant succeeded as Assistant Director. Tarrant had been project leader for intensive study of the effects of pesticides in soil and water at the Station's Forestry Sciences Laboratory in Corvallis since 1965.

Edward H. Clarke has returned to Portland, to become a special assistant to us for the new FALCON program. For the past 10 years, Clarke headed a national research program on timber and wood quality at the Washington, D.C., headquarters of the Forest Service.

Dr. Logan A. Norris succeeded Robert F. Tarrant as Project Leader of Research Work Unit 1603, Behavior and Impact of Forest Chemicals. Norris joined the unit in 1968 after several years of close cooperation while on the faculty of Oregon State University. His personal research is centered on pesticides in the forest environment.

A newcomer to Research Work Unit 1602, Soil Stabilization and Runoff Regulation, is Douglas N. Swanston. Dr. Swanston, a geologist who received his Ph.D. from Michigan State University, is an authority on problems of soil mass movement along the northern Pacific coast. In addition to his Pacific Northwest assignments, Swanston is developing a coordinated program of mass erosion research with the Pacific Southwest and the Intermountain Stations.

H. W. Berndt, former leader of the Water Yield and Erosion project at Wenatchee, has become Assistant Director for the Division of Flood Prevention and River Basin Programs, State and Private Forestry, in the Washington Office of the Forest Service. Dr. William Lopushinsky is Acting Project Leader at Wenatchee.

J. D. Helvey came to the Forestry Hydrology Laboratory at Wenatchee to increase expertise in hydrology. He was formerly at the Coweeta Hydrology Laboratory, Franklin, North Carolina.

John S. Hard was appointed Project Leader for Research on Forest Insects of Coastal Alaska.

Dr. Charles T. Cushwa became Project Leader and Principal Wildlife Biologist at the Institute of Northern Forestry at Fairbanks. He formerly held a position with the Pennsylvania Cooperative Wildlife Research Unit at Pennsylvania State University.

Dr. Robert E. Martin was appointed Project Leader of Cooperative Forest Fire Science at the University of Washington, Seattle, replacing Dr. James L. Murphy, who was transferred to the Washington, D.C., office as Staff Assistant to the Deputy Chief for Research.

Dr. Keith R. Shea, formerly Supervisory Research Plant Pathologist, Forest Diseases of the Pacific Northwest, Corvallis, was transferred to the Washington Office as Branch Chief for Forest Disease Research in the Division of Forest Insect and Disease Research.

Dr. Dennis Schweitzer now leads our Production Economics Research Work Unit. He replaces Dr. Con Schallau who transferred to the Intermountain Station in Ogden, Utah. Dr. Schweitzer joined the PNW Station in 1968, coming from the North Central Station in St. Paul.

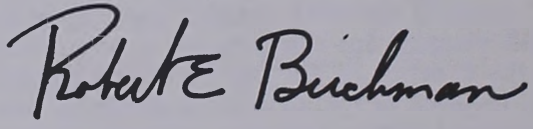
Thomas Farrenkopf, formerly of the Intermountain Station, has joined our Forest Survey Techniques Research Work Unit, increasing the staff to three scientists.

J. D. Burke, Logging Engineer, joined the staff of our Forest Engineering project in Seattle. Burke was formerly with the Snoqualmie National Forest and the Washington Office.

Michael J. Gonsior has joined the staff as a Research Engineer to help with the FALCON program. He comes to the Portland office from the Intermountain Station in Bozeman, Montana, where he had served on the staff of the Forest Engineering Research project since 1965.

Mrs. Barbara Hague, formerly Budget Officer, was named Operations Branch Chief, replacing Lorne Calvert, who transferred to the same position at the North Central Forest and Range Experiment Station in St. Paul, Minnesota.

Charles J. Newlon, former Public Information Officer, transferred to Region 1 in Missoula, Montana, to become Branch Chief for Information Services.



STATION ADMINISTRATION STAFF RESEARCH WORK UNITS AND SCIENTISTS–1971

ROBERT E. BUCKMAN, Director

FALCON PLANNING

CLARKE, EDWARD H. (P)[1]

TIMBER AND WATERSHED MANAGEMENT RESEARCH–DOUGLAS-FIR REGION

ROMANCIER, ROBERT M., Asst. Director (P)

1201 Seeding, Planting, and Nursery Practices in the Pacific Northwest

Stein, William I., Project Leader (P)
Edgren, James W., Plant Ecologist (P)
Owston, Peyton W., Plant Physiologist (C)

1204 Culture of Mixed-conifer Forests, West-side Cascades

Ruth, Robert H., Project Leader (C)
Franklin, Jerry F., Prin. Plant Ecologist (C)
Herman, Francis R., Mensurationist (C)
Minore, Don, Plant Ecologist (C)

1206 Brushfield Reclamation, Prevention and Ecology

Gratkowski, Henry J., Project Leader (R)
Stewart, Ronald E., Silviculturist (R)

1207 Silviculture of Young-growth Douglas-fir and Related Species

Miller, Richard E., Project Leader (O)
Reukema, Donald L., Silviculturist (O)
Williamson, Richard L., Mensurationist (O)

1208 Control of Animal Damage to Western Conifers

Crouch, Glenn L., Project Leader (O)
Dimock, Edward J., II, Prin. Silviculturist (O)
Radwan, M. A., Prin. Plant Physiologist (O)

1401 Breeding Pacific Northwest Trees

Silen, Roy R., Project Leader (C)
Campbell, Robert K., Prin. Plant Geneticist (C)
Sorensen, Frank C., Prin. Plant Geneticist (C)
Copes, Donald L., Plant Geneticist (C)

1602 Soil Stabilization and Runoff Regulation in Conifer Watersheds of Western Washington and Oregon

Rothacher, Jack S., Project Leader (C)
Dyrness, C. Theodore, Prin. Soil Scientist (C)
Fredriksen, Richard L., Soil Scientist (C)
Swanston, Douglas N., Geologist (C)

1603 Behavior of Chemicals Introduced into the Forest Environment and Their Impact on the Ecosystem

Norris, Logan A., Project Leader (C)
Bollen, Walter B., Prin. Soil Microbiologist (C)
Moore, Duane G., Soil Scientist (C)

FOREST ENVIRONMENT RESEARCH—PEOPLE AND FOREST RESOURCES

TARRANT, ROBERT F., Asst. Director (P)

1203 Silviculture of Western Forest Types
Dahms, Walter G., Project Leader (B)
Cochran, Patrick H., Prin. Soil Scientist (B)
Barrett, James W., Silviculturist (B)
Seidel, Kenneth W., Silviculturist (B)

1210 Culture of Coastal Forests in Alaska
Harris, Arland S., Project Leader (J)
Farr, Wilbur A., Mensurationist (J)

1601 Water Yield-Improvement and Erosion Control—Mid-Columbia River Basin Forests
_____, Project Leader (W)
Lopushinsky, William, Prin. Plant Physiologist (W)
Fowler, William B., Prin. Meteorologist (W)
Helvey, Junior D., Soil Scientist (W)
Klock, Glen O., Soil Scientist (W)
Tiedemann, Arthur R., Range Scientist (W)

1604 Control of Erosion and Sedimentation from Road Building and Logging
Meehan, William R., Project Leader (J)

1701 Ecology and Management of Forest and Related Ranges in the Pacific Northwest
Garrison, George A., Project Leader (L)
Geist, Jon M., Soil Scientist (L)
Strickler, Gerald S., Plant Ecologist (L)

1801 Big-Game Habitat Research
Smith, Justin G., Project Leader (L)
McConnell, Burt R., Prin. Plant Ecologist (L)
Skovlin, Jon M., Prin. Range Scientist (L)
Dealy, J. Edward, Assoc. Plant Ecologist (L)
Edgerton, Paul J., Assoc. Plant Ecologist (L)

1901 Wildland Recreation Uses and Social Interaction
Hendee, John C., Project Leader (S)
Potter, Dale R., Assoc. Recreation Specialist (S)

1902 Cooperative Forest Recreation Research, University of Washington
Wagar, J. Alan, Project Leader (S)

2206 Forest Insects of Coastal Alaska
Hard, John S., Project Leader (J)
Torgersen, Torolf R., Entomologist (J)

RESEARCH SUPPORT SERVICES

PETERSEN, CHAS. J., Asst. Director (P)
Hague, Mrs. Barbara R., Operations (P)
Reineke, Mrs. Dorothy E., Programing and Data Processing (P)
_____, Research Information (P)
Knutson, Maurice C., Library (P)
Hansen, George M., Publications (P)
DiBenedetto, A. P., Architecture/Engineering (P)

FOREST PROTECTION RESEARCH; ENVIRONMENTAL SYSTEMS—INTERIOR ALASKA

WRIGHT, KENNETH H., Asst. Director (P)

1651 Environmental Systems—Interior Alaska

Cushwa, Charles T., Project Leader (F)
Barney, Richard J., Prin. Research Forester (F)
Beckwith, LeRoy C., Prin. Entomologist (F)
Helmers, Austin E., Prin. Res. Forester (F)
Viereck, Leslie A., Prin. Botanist (F)
Zasada, John C., Silviculturist (F)
Noste, Nonan V., Assoc. Research Forester (F)

2105 Cooperative Forest Fire Science, University of Washington

Martin, Robert E., Project Leader (S)

2107 Forest Residue Reduction Systems

Pierovich, John M., Project Leader (S)
Dell, John D., Research Forester (P)

2201 Population Ecology and Impacts of Forest Insects of the Pacific Northwest

Wickman, Boyd E., Project Leader (C)
Mason, Richard R., Prin. Insect Ecologist (C)
Mitchell, Russel G., Prin. Insect Ecologist (C)
Sartwell, Charles, Jr., Assoc. Insect Ecologist (C)

2203 Diseases of Western Forest Insects

Thompson, Clarence G., Project Leader (C)
Martignoni, Mauro E., Chief Microbiologist (C)
Stelzer, Milton J., Entomologist (C)
Hughes, Kenneth M., Assoc. Entomologist (C)

2204 Physiology, Behavior and Genetics of Forest Insects of the Pacific Northwest

Carolin, Valentine M., Jr., Project Leader (P)
Ryan, Roger B., Prin. Entomologist (C)
Daterman, Gary E., Entomologist (C)
Schmidt, Fred H., Entomologist (C)
Coulter, William K., Assoc. Entomologist (P)

2208 Aerial Application of Biological Agents and Other Materials for Forest Insect Control

Maksymiuk, Bohdan, Project Leader (C)

2301 Diseases of Douglas-fir, Ponderosa Pine, and Associated Species in the Pacific Northwest

_____, Project Leader (C)
Aho, Paul E., Plant Pathologist (C)
Harvey, George M., Plant Pathologist (C)
Knutson, Donald M., Plant Pathologist (C)

2302 Biology of Root Diseases and Soil Microorganisms

Trappe, James M., Project Leader (C)
Lu, Kuo C., Prin. Microbiologist (C)
Nelson, Earl E., Prin. Plant Pathologist (C)
Zak, Bratislav, Prin. Plant Pathologist (C)
Li, Ching-Yan, Assoc. Microbiologist (C)

BIOMETRICS

Johnson, Floyd A., Prin. Biometrician (P)
Hazard, John W., Biometrician (P)

RESOURCE ECONOMICS, PRODUCTS, AND ENGINEERING RESEARCH

FLORA, DONALD F., Asst. Director (P)

1301 Timber Measurement and Management Planning in the Northwest
Bruce, David, Project Leader (P)
Curtis, Robert O., Prin. Mensurationist (P)

3101 Timber Quality Research for Western Softwoods
Lane, Paul H., Project Leader (P)
Woodfin, Richard O., Jr., Prin. Wood Technologist (P)
Henley, John W., Wood Technologist (P)
Pong, Wee Yuey, Wood Technologist (P)
Plank, Marlin E., Assoc. Wood Technologist (P)

3501 Effective Use of Wood in Building Construction
Grantham, John B., Project Leader (S)
Heebink, Thomas B., Prin. Research Engineer (S)
Oviatt, Alfred E., Jr., Prin. Research Architect (S)

3701 Engineering Systems for Utilization of Heavy Timber Stands of the Pacific Coast Including Alaska
Lysons, Hilton H., Project Leader (S)
Mann, Charles N., Prin. Mechanical Engineer (S)
Peters, Penn A., Prin. Aerospace Engineer (S)
Burke, J. D., Civil Engineer (S)
Carson, Ward W., Mechanical Engineer (S)
Vigna, Carl P., Designer (S)

4101 Forest Survey in the Pacific Northwest
Metcalf, Melvin E., Project Leader (P)
Gedney, Donald R., Prin. Resource Analyst (P)
Berger, John M., Mensurationist (P)
Oswald, Daniel D., Resource Analyst (P)
Bolsinger, Charles L., Assoc. Mensurationist (P)
Wall, Brian R., Assoc. Economist (P)

4102 Improvement of Forest Survey Techniques–PNW
Pope, Robert B., Project Leader (P)
Farrenkopf, Thomas O., Mensurationist (P)
MacLean, Colin D., Mensurationist (P)

4103 Forest Survey for Alaska
Hutchison, O. Keith, Project Leader (J)
Hegg, Karl M., Mensurationist (J)
LaBau, Vernon J., Mensurationist (J)
Laurent, Thomas H., Assoc. Mensurationist (J)
Dippold, Ronald M., Assoc. Photogrammetrist (J)

4201 Economics of Timber Growing
Schweitzer, Dennis L., Project Leader (P)
Fight, Roger D., Economist (P)
Randall, Robert M., Economist (P)
Sassaman, Robert W., Assoc. Economist (P)

4301 Marketing Economics
Hamilton, Thomas E., Project Leader (P)
Adams, Thomas C., Prin. Economist (P)
Darr, David R., Economist (P)
Austin, John W., Assoc. Economist (P)

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[1](P) Portland, Oregon
(B) Bend, Oregon
(C) Corvallis, Oregon
(F) Fairbanks, Alaska
(J) Juneau, Alaska
(L) La Grande, Oregon
(O) Olympia, Washington
(R) Roseburg, Oregon
(S) Seattle, Washington
(W) Wenatchee, Washington

A

Recent staff photos (absent Project Leader is Hank Gratkowski).

Front Row: (A) Bill Morris (Consultant), John Hendee, Ed Clarke, Val Carolin, George Hansen, (B) Dick Miller, Justin Smith, Bob Tarrant, John Hazard, Tom Hamilton, Jim Trappe.

Second Row: (A) Dave Lingwood (Consultant), Dorothy Reineke, Barbara Hague, Hilton Lysons, Don Flora, Bohdan Maksymiuk, Chuck Petersen, (B) Phil Briegleb (retired), Al Hall (retired), Bob Buckman, George Jemison (Oregon State Univ.), Herb Storey (Washington Office), Jerry Franklin.

Third Row: (A) Charles Cushwa, Bill Stein, Hank Thompson, George Harvey, Jack Rothacher, Paul Lane, Jack Grantham, Boyd Wickman, (B) John Hard, Al Harris, Bob Ruth, Owen Cramer, Bob Romancier, Floyd Johnson, Dennis Schweitzer.

Fourth Row: (A) Bill Laycock, Logan Norris, Walt Dahms, Glenn Crouch, Roy Silen, Bob Martin, Mel Metcalf, Ken Wright, Benny DiBenedetto, (B) Dave Bruce, Keith Hutchison, Bill Lopushinsky, George Garrison, Bill Meehan, Bob Pope, Al Wagar.

B

ALASKA IS A CHALLENGE

Southeast Alaska—the Gamut for Forestry

Juneau is headquarters for four research projects. These projects are pioneers in the provident management of the rich and relatively undeveloped forest resource of Alaska's coastal region.

Forest research opportunities now being developed in southeast Alaska include:

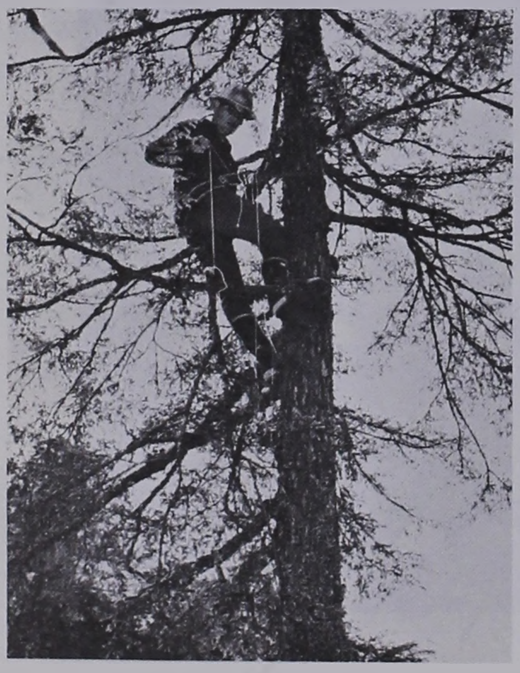
1. Basic inventory data describing the forests and their use.

A vast resource of commercial timber, and relatively accessible, is offered by southeast Alaska with 86 percent of Alaska's sawtimber volume.

2. Measures for preventing losses caused by insects to forests and forest products.

3. Silvicultural practices that will yield the maximum return from coastal forest resource within the objectives of multiple use management.

The research scientist must take to the trees to collect sawfly larvae infesting western hemlock. Control measures will depend on knowledge of the insect's characteristics.



Improvement of trees in Alaska is a future goal of our research. Western hemlock in the coastal forests is the most abundant but Sitka spruce (in photo) is second and comprises 88 percent of the Nation's total supply.

(Continued on page 10)

FOR RESEARCH

The Ecology of Alaska's Interior

A multifunctional team, headquartered in Fairbanks, is responsible for coordinating and conducting research that leads to developing a sound understanding of the ecology of the forest and related lands of interior Alaska. This information is needed to insure protection and orderly development of resources consistent with maintenance of environmental quality.

The team is concentrating initial efforts to:

1. Determine basic ecological processes in undisturbed forests of interior Alaska.

Paper birch stands around Harding Lake. These trees were about 103 years old when photographed. Paper birch is usually a short-lived species in Alaska.

Weighing vegetation samples in studies of black spruce forest productive capacity.

A rain gage in foreground and an automatic soil temperature recorder produce data used in analyzing environmental influences on spruce productivity.

2. Determine the role of fire and other disturbances in interior forests.

Weight of soil samples before and after burning reflects the change in vegetation and organic matter.

(Continued on page 11)

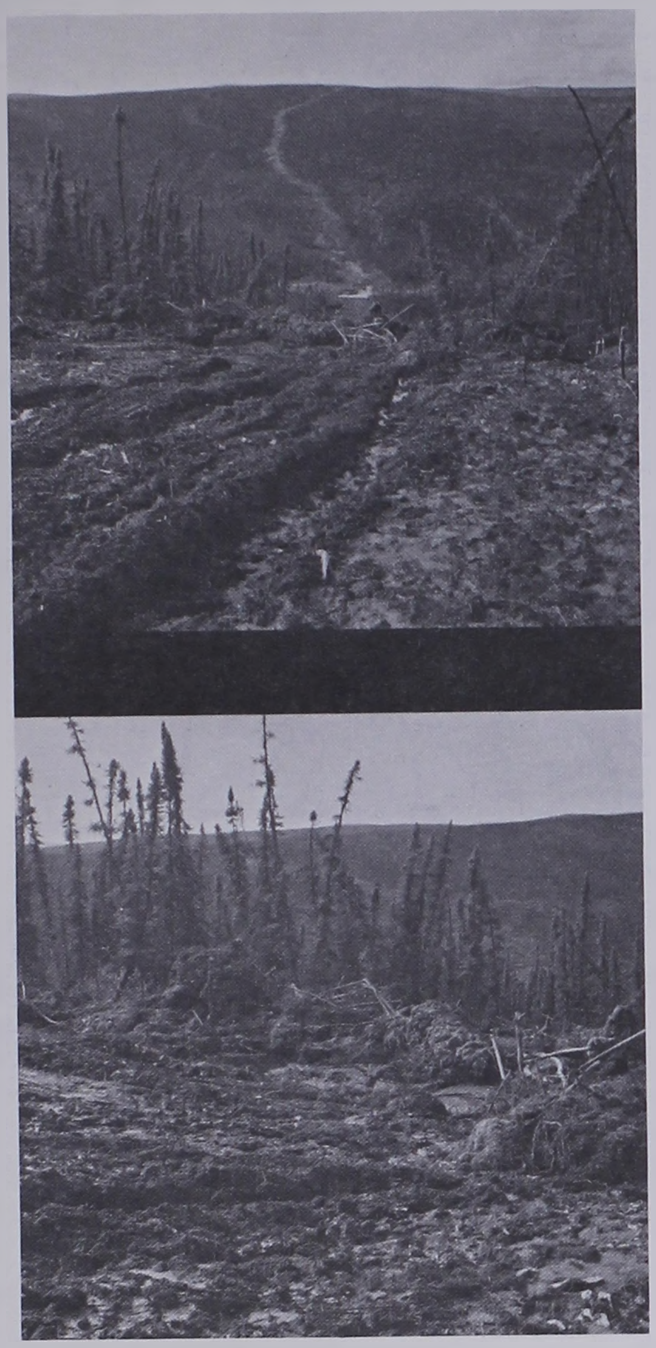
Southeast Alaska (Continued from page 8)

Young-growth stands do well in southeast Alaska but so far comprise only 10 percent of the commercial forest area. Studies indicate that areas now being harvested should produce twice as much volume in the next rotation.

4. Methods for improving water quality; improving and managing fish habitat; preventing erosion, sedimentation, and mass soil movements; and restoring damaged land and stream channels to good hydrologic condition.

Coastal Alaska is mostly steep and mountainous with highly erodable soil. Aerial logging methods will minimize landslides such as shown here.

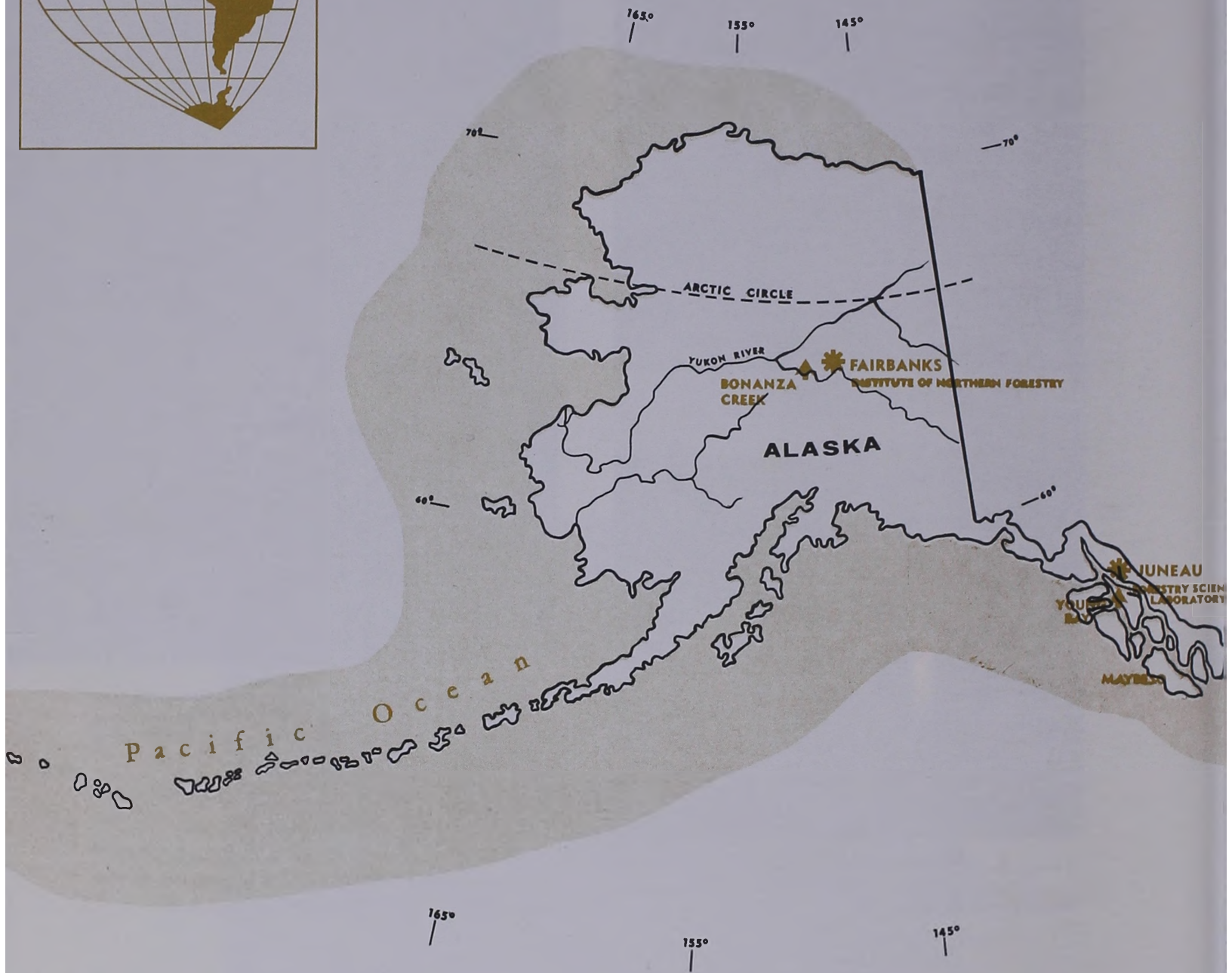
The forest streams must be protected as to water quality and fish habitat. When land and stream channels are damaged, they must be restored.



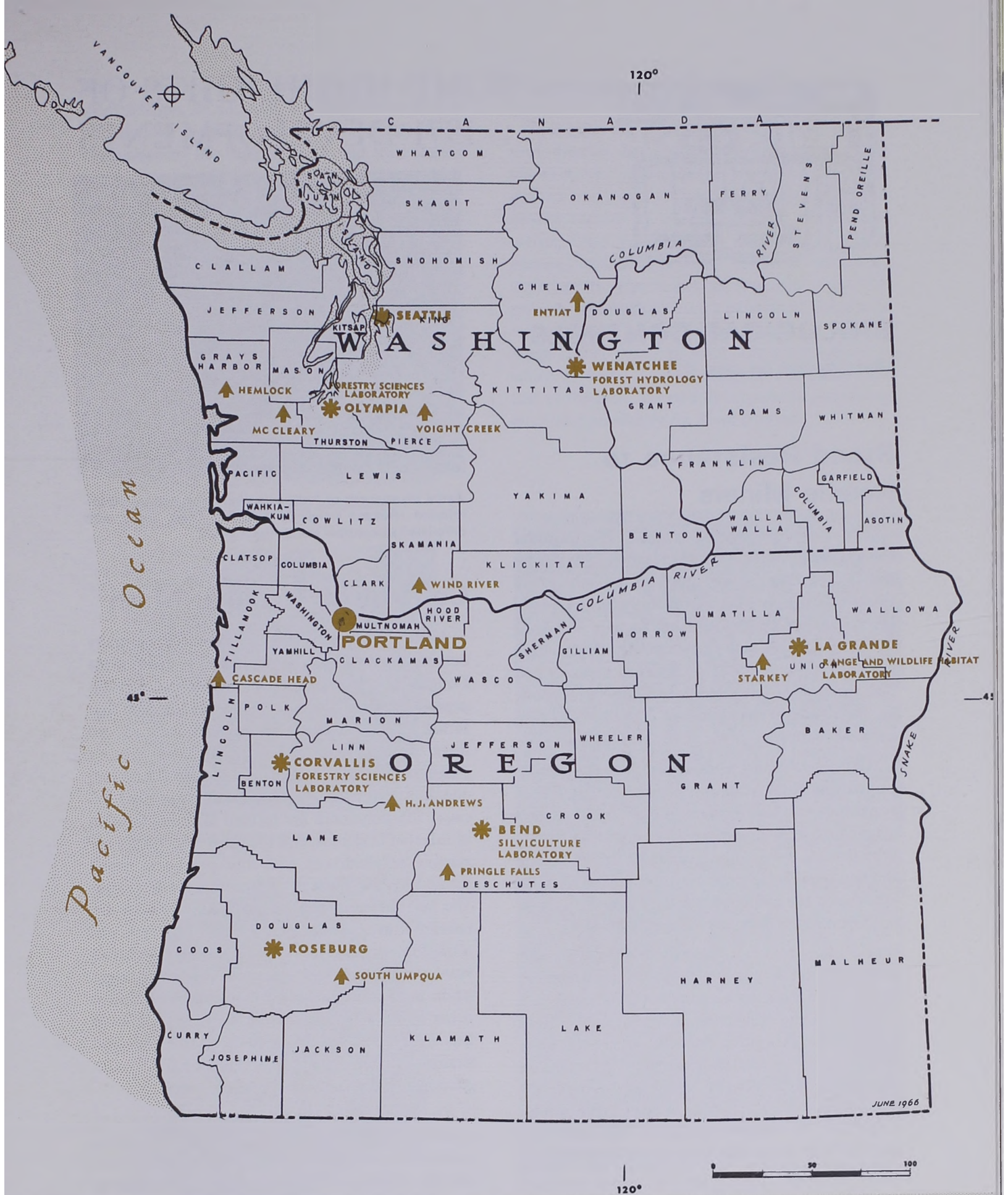
A consequence of fireline construction in areas of permafrost is thawing and cancerlike erosion. Permafrost covers 90 percent of interior Alaska.

Weather study is important in fire control. Here a scientist climbs a 90-foot tower to reach the weather recording instruments. Fires devastate an average of 1 million acres yearly in interior Alaska.

Information from these field investigations will be added to existing knowledge to develop guides for management of forest and related lands.



ACIFIC NORTHWEST FOREST AND RANGE EXPERIMENT STATION



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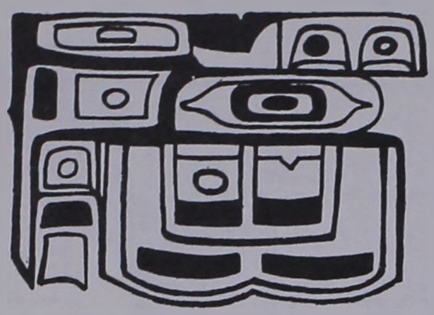


SOME HIGHLIGHTS OF 1971 DEVELOPMENTS

BIOLOGICAL CONTROLS

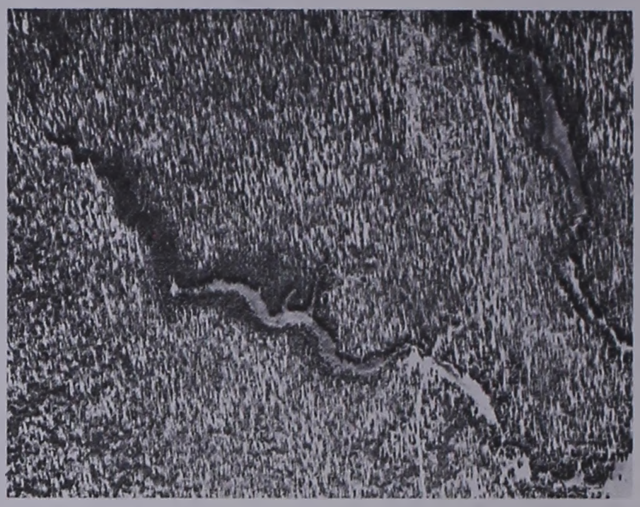
(Publications on page 41)

Stand Resistance to Needle Miners

The lodgepole needle miner (*Coleotechnites* spp.), a serious defoliator of lodgepole pine in central Oregon, attains high populations only where there is a large number of susceptible trees. Populations are several times higher in pure stands of mature lodgepole pine than in young stands with a mixture of ponderosa pine. Recently it was found that the tops of trees and deep-rooted trees growing in drainages have foliage that is especially resistant to attack.

Tests in the field and laboratory have demonstrated that the mechanism of resistance is one of nonpreference, where young larvae reject the resistant type of foliage more often than they do the susceptible type. For example, when newly hatched larvae were caged on different foliage, they mined into the susceptible foliage almost twice as often as into the resistant foliage.

In further studies a volatile leaf oil which could be a deterrent to feeding by young needle miner larvae was found to be associated with resistant foliage. It is especially common in the tops of trees and in trees growing in drainages where foliage is usually resistant to defoliation, but it occurs in only small quantities in susceptible foliage. By developing cultural practices which favor a high proportion of resistant foliage in the stand, we may be able to prevent destructive outbreaks of the needle miner.



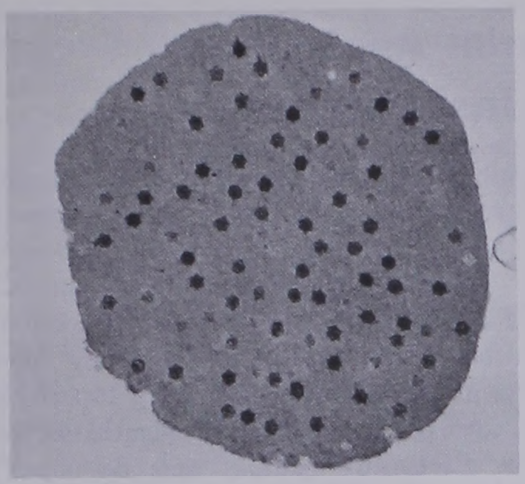
Aerial photograph of lodgepole pine forest comparing uninfested resistant stands in drainages (dark areas) with defoliated susceptible stands (light areas).

Control of Tussock Moth

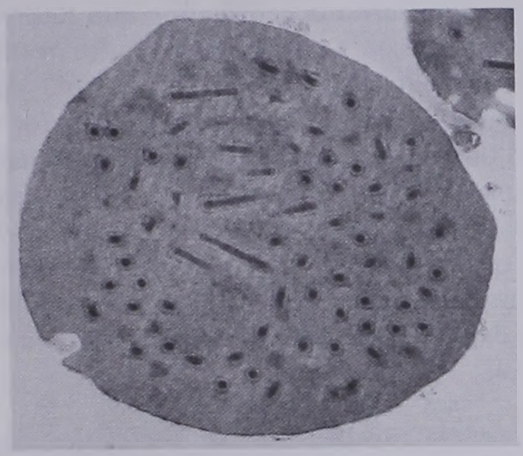
In developing a method for utilizing a naturally occurring virus disease in biological control of the Douglas-fir tussock moth, *Hemerocampa pseudotsugata*, Station scientists have discovered that actually three different viruses are involved. All three viruses occur imbedded in small crystals called polyhedra. Of the three viruses discovered, one is a cytoplasmic polyhedrosis, so called because the polyhedra are formed in the cytoplasm of infected host cells, and the other two viruses are nuclear polyhedroses with the polyhedra being formed in the nucleus of the infected host cell. The two different nuclear polyhedroses were discovered during electron microscope observation of ultra-thin sections of polyhedra. The rod-shaped virus particles of one strain always occur singly while in the other strain, the virus rods always occur in bundles. The isocohedral virus particles in the cytoplasmic polyhedra and the two virus rod strains of nuclear polyhedra can be easily distinguished in the accompanying photographs.

The discovery of the different virus strains is of considerable importance since, before a virus preparation can be used operationally, each strain must be tested and meet stringent Food and Drug

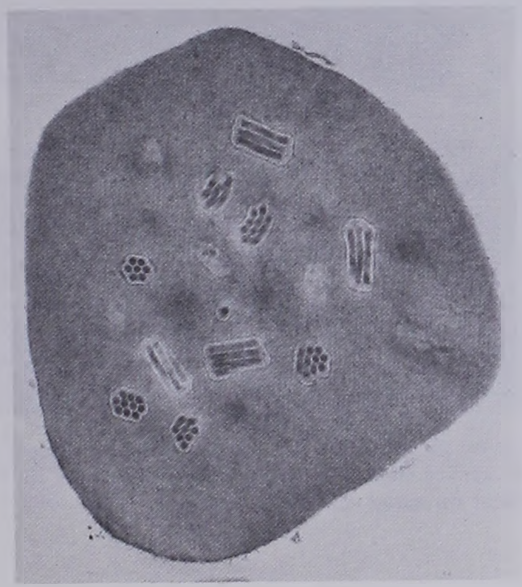
Administration requirements as to safety and virus identification. In addition, the bundle-rod nuclear polyhedrosis appears somewhat more virulent and contagious to the tussock moth and thus should provide a more effective control.



Hemerocampa pseudotsugata **cytoplasmic polyhedron. 26,000 X.**



Hemerocampa pseudotsugata **SV nuclear polyhedron. 26,000 X.**



Hemerocampa pseudotsugata **BV nuclear polyhedron. 26,000 X.**

Parasites of Root Rots

The quest for biological methods for control of root diseases has included a search for hyperparasites, i.e., organisms that parasitize the pathogens of tree roots. A newly discovered fungus has proven capable of overrunning and killing root-rotting fungi such as *Poria weirii, Pythium ultimatum,* and *Rhizoctonia solani* in laboratory experiments. The fungus, an unidentified Basidiomycete, was isolated from a parasitized Douglas-fir mycorrhiza in rotten wood buried in the soil. Since rotten wood provides the microhabitat in which *P. weirii* carries over from one forest rotation to the next, the new hyperparasite presents an intriguing possibility for *Poria* control.

The small hyphae of a newly discovered, virulent hyperparasite have invaded the larger hyphae of *Poria weirii*, which will soon die. X 1,000

CHEMICALS

(Publications on page 41)

Soil Nutrient Studies

Soil deficiencies for nitrogen and sulfur nutrients have been noted in various agricultural areas of eastern Oregon. We have shown that such deficiencies also exist in upland forest soils.

In the greenhouse phase of this work, growth of unfertilized was compared with fertilized orchardgrass (*Dactylis glomerata*) on Tolo soil after urea, ammonium sulfate, and urea with elemental sulfur were added as nutrient sources of nitrogen and/or sulfur. Growth was essentially the same for urea fertilizer applications as with no fertilizer. Ammonium sulfate treatments resulted in growth two or more times that of the unfertilized plants. Further, when sulfur was added to the urea treatment, growth then increased to levels similar to those for ammonium sulfate-treated plants. These findings are already aiding in rapidly covering exposed soil surfaces and providing increased forage for wildlife and livestock.

Herbicide Persistence in Soils

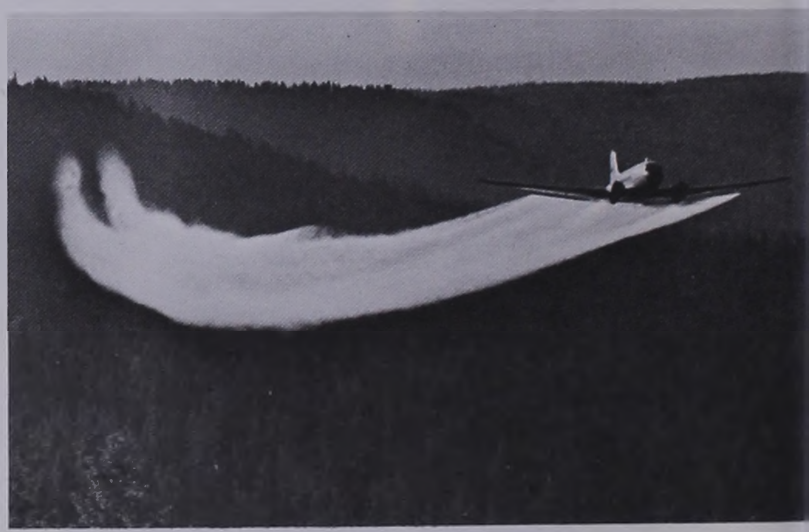
Studies of the behavior of the herbicides picloram and 2,4-D in soil on sprayed rights-of-way established that these chemicals do not leach extensively and are apparently degraded fairly quickly by soil microorganisms.

Residues of 2,4-D and picloram from 0.05 to 0.24 p.p.m. were found in forest floor material 6 months postspray. Soil residues ranged from less than 0.01 to 0.05 p.p.m. in soil 0 to 6 inches beneath the soil surface. Few samples from 6 to 12 inches below the surface and no samples more than 12 inches deep contained detectable herbicide residues. No residues of 2,4-D or picloram were detected in soil from areas sprayed 22 to 58 months before sampling. These results give us confidence that the present pattern of use of 2,4-D and picloram on powerline rights-of-way does not result in long-term soil pollution or movement of chemicals through the soil profile into ground waters.

This publication reports research involving pesticides. It does not contain recommendations for their use, nor does it imply that the uses discussed here have been registered. All uses of pesticides must be registered by appropriate State and/or Federal agencies before they can be recommended.

Aerial Application of Insecticides

Zectran has been registered to use in controlling the western spruce budworm, spruce budworm, and jack-pine budworm—all serious defoliating pests. One of the major difficulties in increasing the effectiveness of this ecologically acceptable insecticide is the lack of reliable spray deposit assessment methods for determining dispersal and forest coverage. Qualitative and quantitative spray deposit assessment methods were developed in 1971 for the registered Zectran formulation and successfully field-tested in a research experiment conducted in Idaho in cooperation with Region 1, Insect and Disease Control Branch. These methods utilize a fluorescent tracer, both for rapid visual determination of the spray deposit and for detailed fluorometric analyses for the quantitative assessments. This quantitative method was used to correlate the amount of deposit on tree crowns with spruce budworm mortality, and to identify improvements needed to obtain more uniform spray deposit coverage for achieving greater insect control.

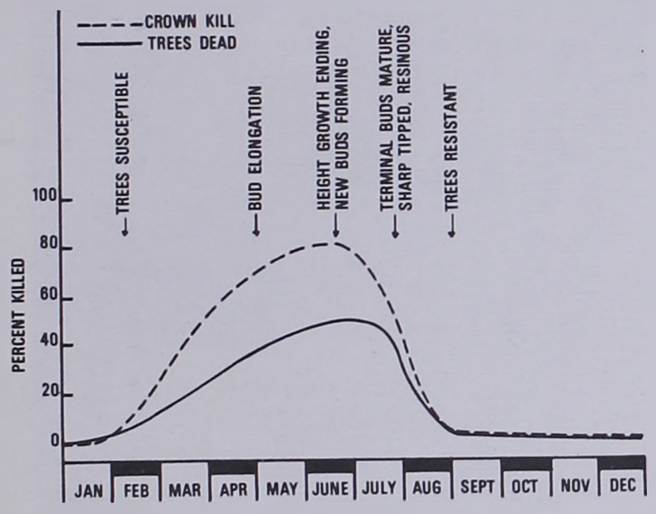


Application of registered Zectran formulation against the western spruce budworm containing Rhodamine fluorescent tracer for spray deposit assessment.

Seasonal Susceptibility of Ponderosa Pines to Phenoxy Herbicides

Correct timing of herbicidal sprays is necessary to successfully release young conifers from brush competition in Pacific Northwest forests. Aerial sprays must be applied when they will produce an acceptable kill of competing shrubs with minimum adverse effects on the trees. Proper timing is especially important with ponderosa pines, which are very susceptible to damage from herbicides.

In the Cascade Range in southwestern Oregon, young pines became susceptible to damage from 2,4-D and 2,4,5-T in mid-February, 2½ months before bud swelling signalled the beginning of the spring flush of growth. Young pines were most susceptible during active growth in May and June. Susceptibility decreased rapidly after new buds began to form in late June, but full resistance was not attained until the end of August. The pines were then resistant to phenoxy herbicides until late winter.



This information indicates that phenoxy herbicides can safely be used to release young pines only during the period from late summer through early winter. During late winter and spring, even pines that appear to be dormant are likely to be damaged.

ECONOMICS IN FOREST MANAGEMENT

(Publications on page 43)

Simulation Model for Calculating Allowable Cut

We have developed mathematical programing techniques to provide an alternative method of determining the level of cut for regulated forests. In cooperation with the Bureau of Land Management, we have produced a forest projection model called SIMAC (Simulated Intensively Managed Allowable Cut) that is specifically designed to calculate allowable cuts for intensively managed forests. It permits estimates of the allowable cut which will result from the application of a specified regime of management practices to an even-aged forest. The model is adapted to estimating future timber supplies from both public and private timber lands in the Douglas-fir region.

ECONOMICS IN WOOD INDUSTRY

(Publications on page 43)

Markets for Logging Residue

Forest managers are seeking ways to reduce logging residue so that cutting areas have a cleaner appearance, are less of a fire hazard, and are more suitable for reforestation and subsequent management. An objective of marketing research is to identify economic incentives for greater logging utilization. One phase of this research involves measuring potential recovery values from substandard or utility grade logs.

A recovery study was conducted at a combined lumber and chip mill, selected because it had a special market for the kinds of lumber that can be produced from these logs. Results showed that the profitable logs were chiefly those 8 to 12 feet long, yielding 40 percent or more of their gross volume as lumber. Often these were the better portions of longer logs, bucked in the mill for maximum lumber recovery. The poorer quality segments had little or no conversion value but were utilized because they were part of the longer logs which contained the better segments.

Low quality logs, suitable only for chipping, were not profitable in this mill, which required all logs to be put through the circular headrig, even for chipping.

A conclusion of this study is that only the better logs in the utility grade classification are economic for utilization in a combined lumber and chip recovery mill. Further, with today's prices and technology, any major effort to reduce logging residues by converting them to products cannot be justified solely on economic grounds.

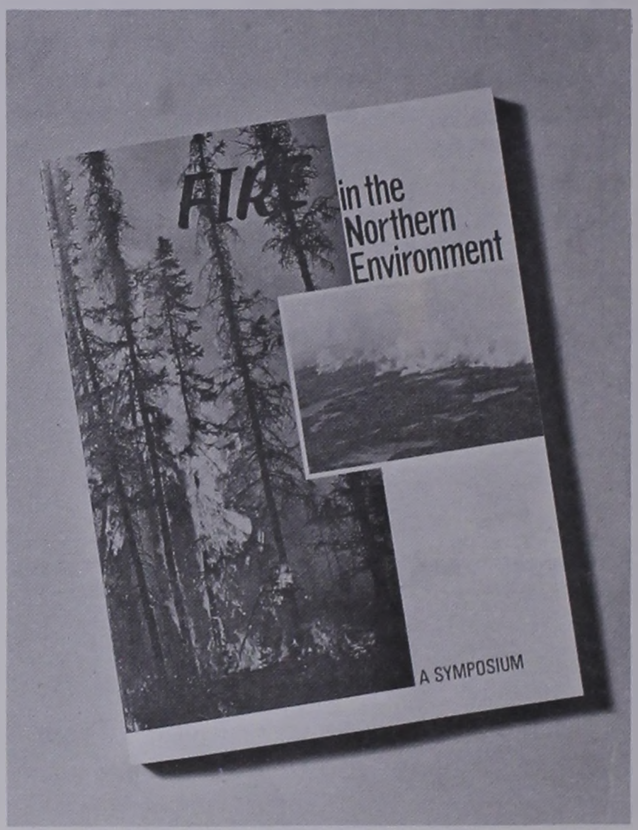
Marketing research aims toward development of markets for large cull logs which make up a sizable part of logging residues.

FIRE

(Publications on page 44)

Fire in the Northern Environment

A symposium to discuss current questions and opinions on wildfires was held at the University of Alaska, Fairbanks. During the 2-day session, over 100 persons representing 30 organizations participated. This was the first effort in Alaska to bring together natural resource managers, fire control specialists, scientists, and citizens to explore wildfires, their control, and role in Alaska's environment. The 275-page proceedings includes 21 papers, a panel discussion, keynote address, symposium summary, and list of participants. Copies are available from the Station.



GENERAL

(Publications on page 44)

Where Mother Nature Rules

Research Natural Areas are tracts of Federal lands which are set aside for research and educational purposes. As examples of ecosystems undisturbed by man they provide: (1) Natural controls for comparison with managed tracts, allowing us to determine the beneficial and detrimental effects of land management practices; (2) Opportunities for studying the ecology of organisms or behavior of ecosystems under natural conditions; and (3) Gene pools and preserves for various plants and animals, including those which are rare and endangered.

The Station has a major interest in establishment of Research Natural Areas in the Pacific Northwest. Research Natural Areas are research facilities as essential to the Station's program as the laboratories or experimental forests and ranges. Consequently, the Station is playing a leading role in this cooperative Federal program, which involves the Atomic Energy Commission, Bureau of Land Management, Bureau of Sport Fisheries and Wildlife, National Park Service, and Forest Service.

During 1971, excellent progress has continued in identifying the kinds of ecosystems which still require representation within Research Natural Areas and in locating appropriate examples of these ecosystems. Among the tracts identified were two underrepresented old-growth Douglas-fir areas in the Oregon Cascade Range and one of redwood forest type near the northern limits of the species range in southwestern Oregon. Also during 1971, the Station, in cooperation with the involved agencies, was host to members of the Federal Committee on Research Natural Areas (a Federal interagency group) and of the Conservation of Ecosystems Section in the International Biological Program. One of their purposes was to examine the exemplary Research Natural Area program in progress in this region.

Station personnel have also led in the drafting of "Federal Research Natural Areas in Oregon and Washington: A Guide for Scientists and Educators." This interagency guidebook, to be published by the Station in 1972, will provide information on the features of each of the 48 existing Research Natural Areas in the Pacific Northwest. It should assist materially in seeing that these areas are more fully and properly used in academic and governmental research programs.

Old-growth redwoods growing near the northern limits of the species range in the proposed Wheeler Creek Research Natural Area, Siskiyou National Forest.

Old-growth Douglas-firs typical of those found in the proposed Bagby Research Natural Area, Mount Hood National Forest.

Mixed ponderosa pine and Douglas-fir forests on the recently established Ashland Research Natural Area, Rogue River National Forest.

There is a long history of scientific use of Research Natural Areas in this region. Pictured in 1971 is one of the protective screened frames used by Leo Isaac in 1928 in his classical study of Douglas-fir seed storage and survival in duff and litter layers. Wind River Research Natural Area, Gifford Pinchot National Forest.

Western redcedar swamp on the Wind River Research Natural Area, Gifford Pinchot National Forest.

GENETICS

(Publications on page 45)

Frost Resistance in Douglas-fir Races Related to Bud Set and Latitude

Date of bud set can be used to screen races of coastal Douglas-fir for fall frost resistance, but adding a factor related to latitude markedly improves precision of the screening.

At the same stage of bud set, seedlings from northern sources were more resistant to an October frost than seedlings from southern sources, in a study of 10 races growing in a genetics nursery at Corvallis, Oregon. Races came from eastern and western slopes of the Coast Ranges in western Washington and Oregon.

In races that set buds earliest, bud set preceded frost by 5 weeks; in the latest, by 2.75 weeks. For each week by which bud set preceded frost, the proportion of frost-damaged seedlings decreased by 25 percent. At identical bud stage, the proportion of damaged seedlings increased by 4 percent per degree of decreasing latitude.

Since seedlings from southern sources generally set buds later and were at the same time more sensitive, they were much more severely damaged. Seedlings from the southernmost coastal source (Coos Bay, Oregon) suffered 78-percent damage, and the northernmost coastal seedlings (Soleduck), 10-percent.

Leader Shearing Seed Orchard Trees

Collecting cones from grafted Douglas-fir trees in seed orchards becomes a serious problem when the trees grow taller than 25 feet. Climbing taller grafted trees to collect cones is prohibitive because of the fragility of many graft unions. Thus, effective technology for controlling tree height must be developed.

A study was initiated in 1965 in four Oregon and Washington seed orchards to limit annual height growth to either 1.0 or 1.5 feet. In 1971 enough cones were produced in the four orchards to permit comparison of leader-sheared and unsheared trees. Briefly, 1.0-foot sheared trees were 64 percent as tall as the control trees but had only 57 percent as many cones as the controls. Trees sheared to 1.5 feet per year had only 64 percent as many cones as unsheared controls.

Thus, after 6 years of top-shearing, the desired height reduction was obtained, but only with an appreciable reduction in cone production. But the true value of leader shearing will not be evident until unsheared trees become too tall for cones to be picked from their upper crowns. When this occurs, it is likely that the harvest from the shorter sheared trees will be greater than can be reached on the taller unsheared trees.

Elite Christmas Tree Seed

A major landmark in northwest forest genetics has been reached this year with release by our Station of about 13 pounds of elite, or genetically superior, Christmas tree seed. The seed originates from the best parents found in a Christmas tree study begun in 1964. At that time wind-pollinated seed of the parent trees, 50 in Oregon and 50 in Washington, was collected with cooperation of the Washington Department of Natural Resources geneticists. Seedlings from each parent were distributed to eight cooperating Christmas tree growers in 1966, who planted them in a standard test design. Some of the better parentage was detectable from their progeny by 1968, but proof of superiority came as the first went to market this year. Best parents produce premium quality trees in higher proportion or become marketable a year or more earlier. An equitable distribution of the superior seed has been worked out through the U.S. Forest Service, State and Private Forestry Division, for the benefit of the northwest Christmas tree industry.

INSECTS

(Publications on page 45)

Inherent Variation in Spruce Budworms

One of our project objectives is the recognition of heritable characteristics of insect populations. With a cosmopolitan insect such as spruce budworm, we would expect different populations to have different developmental characteristics based on their genetic makeup and bearing on survival and thus degree of damage caused.

Different patterns of development, which are characteristic of the insects themselves and not due to external factors, have been found in representatives of two western budworm species and populations. *Choristoneura viridis* larvae were found to have six, seven, or eight molts (instars) and *C. occidentalis* to have five, six, or seven molts. The growth rate is the same for either sex within each instar group and differs between instar groups, being slower in groups with additional instars. Time to pupation also increases as the number of instars increases.

Other things being equal, rapidly developing populations or segments of population are expected under natural conditions to show highest survival and constitute the greatest threat. However, other heritable characteristics such as fecundity must also be considered, with full recognition that populations are substructured.

Insect Supercooling

Winter cold is a major factor in insect population fluctuations. This is particularly true in Alaska, where the spruce beetle, *Dendroctonus rufipennis*, does not survive freezing; however, it avoids freezing by supercooling. Laboratory experiments with a field population near Fairbanks, Alaska, show that this species can supercool anytime during the year and that the supercooling point is depressed to -38.8° C. during midwinter. Air temperatures frequently drop below this point, but much of the population is protected by snow cover. In general, the supercool level of adults is not as low as that for the larvae.

The change in the ability to supercool throughout the year indicates that it is a function of body chemistry. Glycerol is present during the winter but may not be the only compound responsible for the supercooling. An understanding of when and how these phenomena occur will be helpful in predicting trends of insect populations.

Temperature and the Black-headed Budworm

Temperature during active periods of the black-headed budworm life cycle in Alaska is importantly related to budworm population fluctuations.

Analysis of two recent budworm outbreaks in southeast Alaska showed a highly significant relationship between acres of forest defoliated in a given year and mean of the temperatures (temperature index) during the mating and oviposition period the previous year and the larval period in the year defoliation occurred. This temperature index has a long-term mean of 53.18° F. in southeast Alaska. Defoliation by the budworm increased in years with temperature indices above the long-term mean and decreased in years with temperature indices below the long-term mean.

This finding supports the hypothesis that animal populations are controlled largely by weather near the peripheries of their natural ranges. Southeast Alaska is near the northern extremity of the budworm's geographic distribution.

Preparing insects for freezing experiments.

LOGGING

(Publications on page 46)

Balloon and Skyline Logging Improvements

This year marked a major milestone in our efforts to introduce aerial logging methods. The first balloon logging system for use in Alaska was purchased by an Alaskan company, and plans are to begin on the Tongass National Forest early in 1972. New balloon logging operations were begun on the Boise National Forest, while balloon logging operations near Eugene, Oregon, continued. A new mobile running skyline yarder operation started on the east side of the Mount Hood National Forest. This new yarder, which was developed to our specifications, is designed to economically harvest partial cuts in areas considered too steep or fragile for tractor logging. It is capable of yarding either clearcuts or partial cuts over distances of up to 2,000 feet with much less adverse impact on the forest environment.

A new mobile running skyline yarder developed from Station Engineering Research.

A natural-shaped balloon in use on a logging operation.

MENSURATION

(Publications on page 46)

Measuring Stand Density

Numerous methods have been used to express relative stand density and competition in thinning and yield studies and in control of intermediate cuttings. Many such measures have a common interpretation as comparisons of average area available per tree with that occupied by trees growing under a standard condition of competition and comparable in diameter or height or site and age.

We derived and compared a number of such relative density measures for Douglas-fir. Most are closely related and can be grouped into a few classes, with those in any one class being interchangeable in practice. One of the simplest of such measures is a sum of diameters to a suitable power ($\Sigma[D^{1.55}]$ for Douglas-fir), which can be shown to represent a tree-area ratio which is logically and practically equivalent to several older and generally accepted measures of relative stand density such as crown competition factor, stand density index, and tree area ratio.

Improved Stand Table Projections

A major problem in making stand table projections for timber supplies has been that of estimating future growth and mortality rates. The approach followed has been to adjust initial rates in response to changes in average basal area per acre, using relationships developed from Forest Survey plots. However, the growth and mortality constraints have been independent of each other, so they haven't always prevented an unreasonable buildup of stand density.

We have now developed a new approach which enables us to establish a firm limit on the buildup of basal area per acre. Initial radial growth and mortality rates are adjusted during the course of a projection, so that net basal area growth is reduced to zero as average basal area approaches a maximum set for the species type and area projected. This approach is producing more reasonable stand densities than the previous method for long-range projections of timber supply.

Dunning's Site Class Estimated from Plant Indicators

We have recently developed five equations for estimating Dunning's site class by observing the presence or absence of certain plants and other indicators. Each of the equations is designed for a specific geographic area in California. Together, they apply to most of the Sierra Nevada and about half of the Coast Ranges. The equations should be useful for estimating Dunning's site class on cutovers, burns, and other areas where suitable site trees are absent. They can be readily applied by anyone able to identify a few common species of plants. The chances are better than two out of three that the estimate will be within one class of the true site class.

Defect Estimation in White Fir

Decay fungi cause large volume losses in commercial white fir forests in southwestern Oregon. Accurate methods for estimating this defect have long been needed for efficient utilization and management of this resource. Methods have now been developed for relating defect to external indicators for use on the Rogue River National Forest. The most important indicators of defect are conks of heart rot fungi, basal injuries, frost cracks, trunk wounds, forks, and dead or broken tops. Conks of the Indian paint fungus are the most reliable indicator. Defect deductions can be made either as percentages of gross tree cubic- and board-foot volumes or as average length deductions above and below indicators.

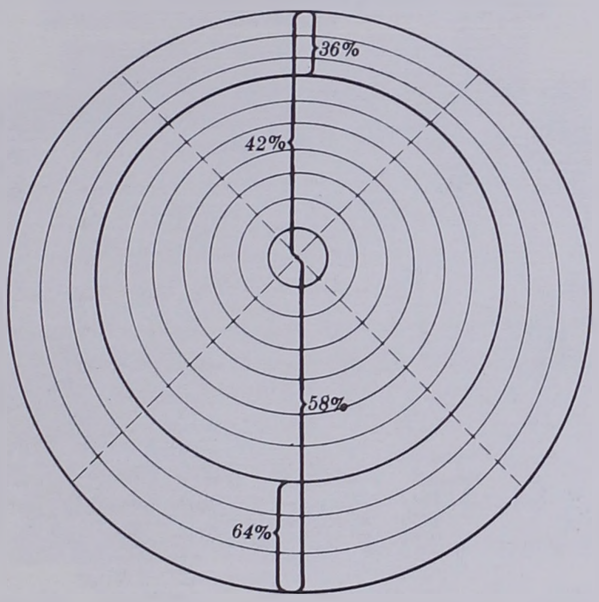
Cross sections of *Echinodontium tinctorium*, Indian paint fungus, decay in a white fir at 32, 49, 65, 81, and 98 feet.

Determination of Past Diameter Growth

We frequently estimate diameter growth from measurements of radial growth on either increment cores or cross sections of felled trees. The accuracy of this estimate is strongly dependent upon which radii we measure. Differences in relative growth on different radii are generally greater than differences in relative current lengths of these radii (see figure).

Thus, if one measures only a long radius and adjusts measured growth by the current ratio of its length to the diameter of the section (as determined by a diameter tape), he will underestimate past diameters; recent rates of diameter growth will be overestimated, and early rates will be underestimated. Conversely, similarly adjusted measurements made on only a short radius will lead to overestimates of past diameters and underestimates of recent growth. If we do not balance these differences, our estimate of diameter growth may be considerably in error, and so may our estimates of relative change in growth rate from one period to another.

In western Washington, the northerly and easterly sides of the stem quite consistently grow faster than average, and the radius exhibiting the slowest growth rate is generally nearly opposite that exhibiting the fastest rate. Moreover, examination of numerous cross sections has revealed that patterns of growth tend to be more consistent and representative on these than on other radii. Therefore, measurements on two radii which form an average diameter passing through the pith generally will give a good estimate of diameter growth. In practice, one can measure diameter with a diameter tape and use a caliper to determine a specific average diameter for measuring or boring.



Typical pattern of radial growth. In this example, current length of the long radius is 58 percent of the diameter, and radial growth on this radius during the period denoted by heavy rings was 64 percent of diameter growth.

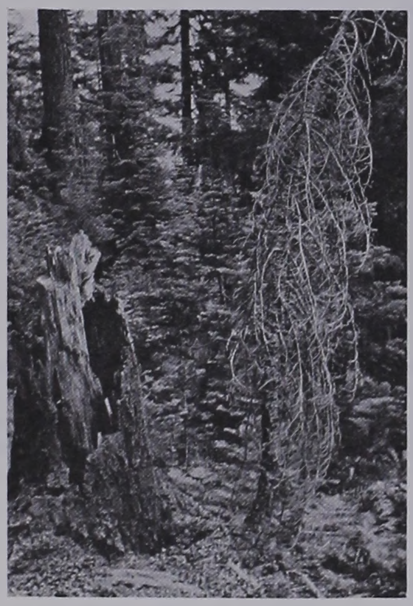
PATHOLOGY

(Publications on page 47)

Poria weirii— A Plantation Disease

Poria weirii has been widely recognized as causing a lethal root rot of conifer poles and sawtimber throughout the Douglas-fir region. Now, however, the pathogen has been identified as a killer of reproduction in numerous Douglas-fir plantations west of the Cascades. It persists in buried wood after an infected stand has been harvested, lying in wait for contact by roots of the succeeding stand.

This sequence of events usually takes several years. Consequently, a plantation that appeared healthy for its first 10 to 15 years may suddenly begin to suffer mortality from *P. weirii*. The mortality can be expected to increase as surviving trees grow larger and extend their root systems to contact *P. weirii* on roots of their infected neighbors. In view of the devastating potential of *P. weirii* in infected young stands, the Region 6 Forest Insect and Disease Control Branch, the Mount Hood and Siuslaw National Forests, and the Station have initiated joint studies to develop silvicultural methods to minimize the damage.



Mycelium of *Poria weirii* persisted in the roots and stump of a tree killed long before by the fungus. The mountain hemlock that subsequently became established near the stump was infected with *Poria* when its roots contacted the buried inoculum, and it died as a sapling.

Protecting Port-Orford-cedar from *Phytophthora* Root Rot

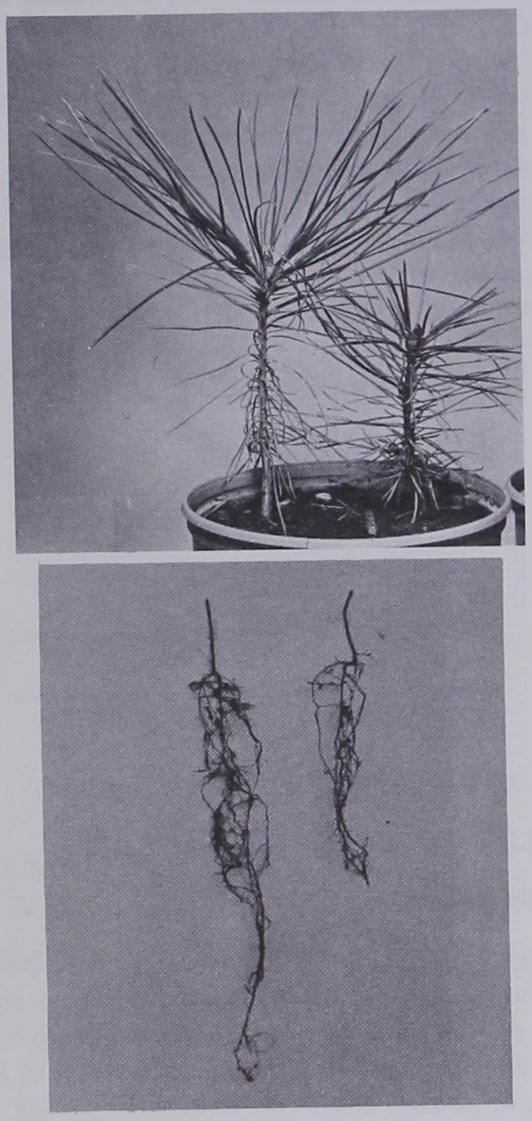
The valuable and biologically unique Port-Orford-cedar has been threatened with virtual extinction since appearance of the highly infectious root pathogen *Phytophthora lateralis* in the tree's natural range. The fungus can be spread in flowing water or by movement of soil on feet or machines from infected to uninfected areas. No evidence of inherent resistance has been found in several thousand trees tested, and the outlook for chemical control is poor.

Forest pathologists of Oregon State University, Region 6, and the Station have cooperated in developing recommendations for delaying spread of *Phytophthora* to uninfected stands of Port-Orford-cedar. The recommendations emphasize excluding people, animals, and equipment from uninfected stands. Road construction and logging should never be done uphill from stands to be protected. In logging infected stands, all cedars, including seedlings, should be destroyed to remove the food base of the fungus.

Dead young Port-Orford-cedars. *Phytophthora lateralis* was introduced during logging of Douglas-fir overstory. (Photo, courtesy Oregon State University, Corvallis.)

Dwarf Mistletoe on Seedlings

Dwarf mistletoe reduced the growth of both roots and tops of ponderosa pine seedlings 1½ years after they were infected. In a comparison of infected and uninfected seedlings, infected roots weighed only 52 percent of uninfected roots and infected tops weighed 58 percent of uninfected tops. The length of infected roots was 78 percent of the length of uninfected seedlings. Because of the reduction in root volume and length, infected pine seedlings suffer a competitive disadvantage for soil moisture and nutrients. Infected seedlings are, thus, a poor risk and should be eliminated from managed stands.



A healthy ponderosa pine seedling (above) and a seedling infected with dwarf mistletoe (below).

PHYSIOLOGY

(Publications on page 48)

Forest Trees and Shallow Water Tables

Forest trees along stream bottoms and the lowlands around lakes and reservoirs are becoming increasingly desirable as recreational use of our streams and lakes increases. However, not all forest tree species are able to grow over the shallow water tables which underlie most lowlands. Some grow well; others cannot grow at all. Knowledge of species-water table relationships is essential if these areas are to be fully utilized.

A comparative study of native tree species growing in the swamps and stream bottoms of the Olympic Peninsula showed that both depth and quality of water tables influenced species occurrence and tree growth. Red alder and Sitka spruce grew well in wet stream bottoms where winter water tables were extremely shallow and the water was flowing. Red alder and western redcedar grew well where very shallow stagnant water tables occurred near lakes and ponds; Sitka spruce did not. Western hemlock grew very slowly wherever winter water tables were extremely shallow, regardless of water movement. Douglas-fir was not found on wet areas, not even where these areas were surrounded by Douglas-fir forest growing on higher ground.

PLANT ECOLOGY

(Publications on page 48)

Reestablishment of Understory

A study of buried seed population in three widely separated grand fir forest stands in northeastern Oregon has provided information on reestablishment of understory plants when these stands are patch clearcut. In a glasshouse study of seedling emergence from litter and surface soils

under grand fir forests, average germinating seed numbers ranged from 25 to 80 per square foot to a 4-cm. soil depth. Seedling numbers were highest in the litter and decreased significantly with depth. There was a trend toward higher numbers of seedlings emerging from samples initially heated to 60° and 80° C. than from cooler or hotter temperatures, and from full sunlit samples than from those shaded. Plant community sampling listed 42, 30, and 10 understory species present in three stands, but only 14, 3, and 0 of these, respectively, emerged from the litter and soil samples. The majority of the "new" species were those which become increasingly important in plant succession after these stands are logged. Apparently the buried seed population is the prime source for the plant succession observed in the first years following logging of grand fir. Further, harvest methods and site treatments affecting light intensity and temperatures at the ground surface influence germination of buried seeds of different species differently, thereby establishing a specific successional pattern.

Emperor Views Alaska Display

Japanese Emperor Hirohito, returning home from a seven-nation European tour, stopped briefly in Anchorage. Dr. Leslie Viereck, plant ecologist, Institute of Northern Forestry, Fairbanks, and John Raynor, resource forester from the Chugach National Forest, Anchorage, set up a display of plants found in both countries. Herbarium specimens and appropriate taxonomic references, "The Flora of Alaska and the Flora of Japan," were reviewed by the Emperor and Empress while Dr. Viereck explained the relationships between Japanese mountain flora and the flora of Alaska.

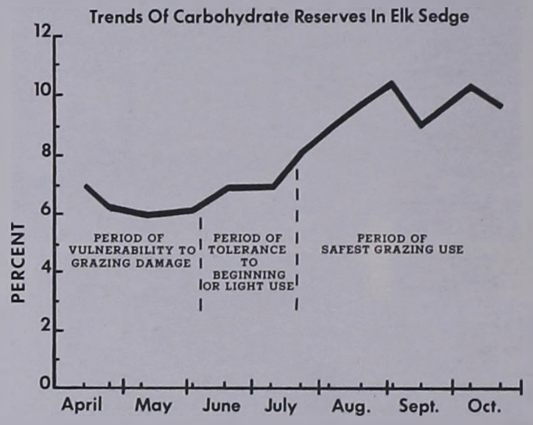
RANGE ECOSYSTEMS

(Publications on page 49)

Food Reserves in Elk Sedge

Elk sedge (*Carex geyeri*), a key herbaceous species in the understory of Northwest ponderosa pine ecosystems, is a high value livestock forage plant. The figure shows the seasonal trend of the stored food or carbohydrate in elk sedge.

Elk sedge starts growing very shortly after the snow cover melts; thus, stored food reserves are reduced early in the season. After leaf growth terminates in early July, food reserves accumulate rapidly. The first growth period is not suitable for grazing, and in the second period, the plant is just sufficiently tolerant to grazing use that such a grazing system as deferred-rotation is called for as a prudent management procedure. During late summer, food accumulations in the plant become adequate and reasonable utilization of the plant by livestock can be allowed with minimum effect on maintenance of the plant.



Heavy Grazing Reduces Quality of Bitterbrush Forage

Bitterbrush (*Purshia tridentata*) is a widespread, highly palatable western range shrub. Heavy grazing of this shrub increases yield per plant but reduces yield per acre because the lifespan of the heavily grazed plants is shortened. Quality of forage may be as important as quantity. We studied heavily and moderately grazed stands of

bitterbrush to learn how protein content varies with plant age, and how the relationship between protein and age is influenced by grazing.

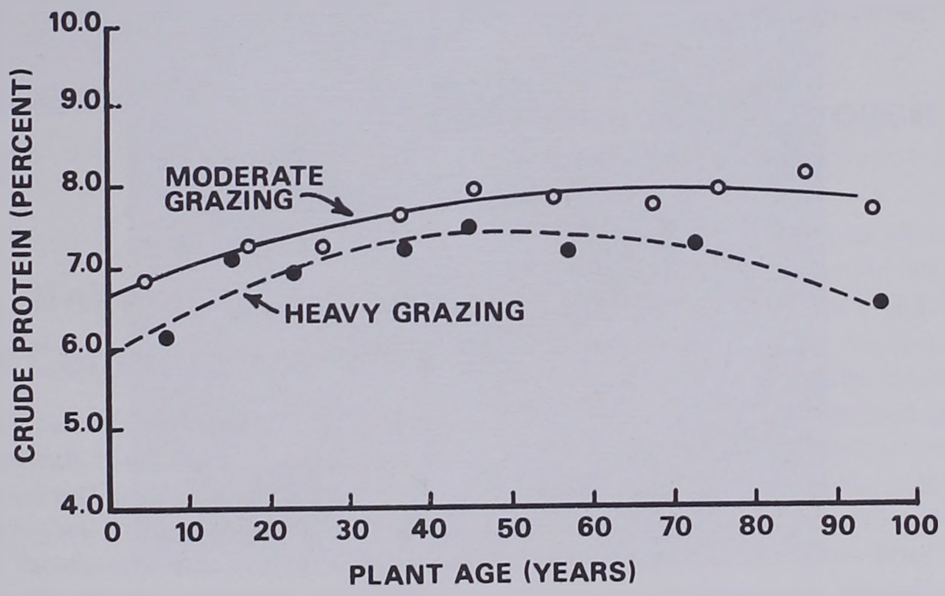
Protein content fluctuates with plant growth stage. In this study the plants were collected at or near the low point in the annual cycle. The relationship of protein content to age was similar under both moderate and heavy intensities of use, rising through the younger age classes to a peak—at about 50 years where heavily grazed and 70 years where moderately grazed—and then declining. More important, the moderately grazed plants were always higher in protein than the heavily grazed ones. Absolute differences in protein between intensities of use are not large, but they could make the difference between an adequate and an inadequate maintenance requirement for deer on a marginal winter range.

Revegetation Following Forest Fire

Following the fire on the Entiat Experimental Watersheds, permanent belt transects were established to evaluate the progress of revegetation occurring both naturally and as a result of rehabilitation by grass seeding and fertilization. Three drainages were treated with various combinations of grass seed and fertilizers (urea and ammonium sulfate). One watershed was maintained in an unseeded, unfertilized condition as a control.

By August 1971, a year after the fire, about 9 percent of the ground surface was covered by vegetation. Most of the vegetal cover was native species, particularly those which sprout from a rootstalk or rhizome such as snowbrush ceanothus, willow, pinegrass, and dogbane. Reseeded species, comprising an average of 32 percent of the vegetal cover, were most prominent on slopes of less than 30 percent in stream bottoms and where residual dead trees provided partial cover. Fertilization did not appear to significantly affect the amount of vegetal cover.

In separate seeding trial, cereal rye, winter wheat, Florida broadleaf mustard, giant curled mustard, pinegrass, luther barley, cheatgrass, fourwing saltbush, and arbor lupine were used. Excellent vegetal cover, up to 40 percent of the ground surface, was obtained with cereal rye, winter wheat, Florida broadleaf mustard, and giant curled mustard, indicating that these species may have considerable value in rehabilitation programs.



Relationship between percent crude protein content and age of bitterbrush under heavy and moderate grazing.

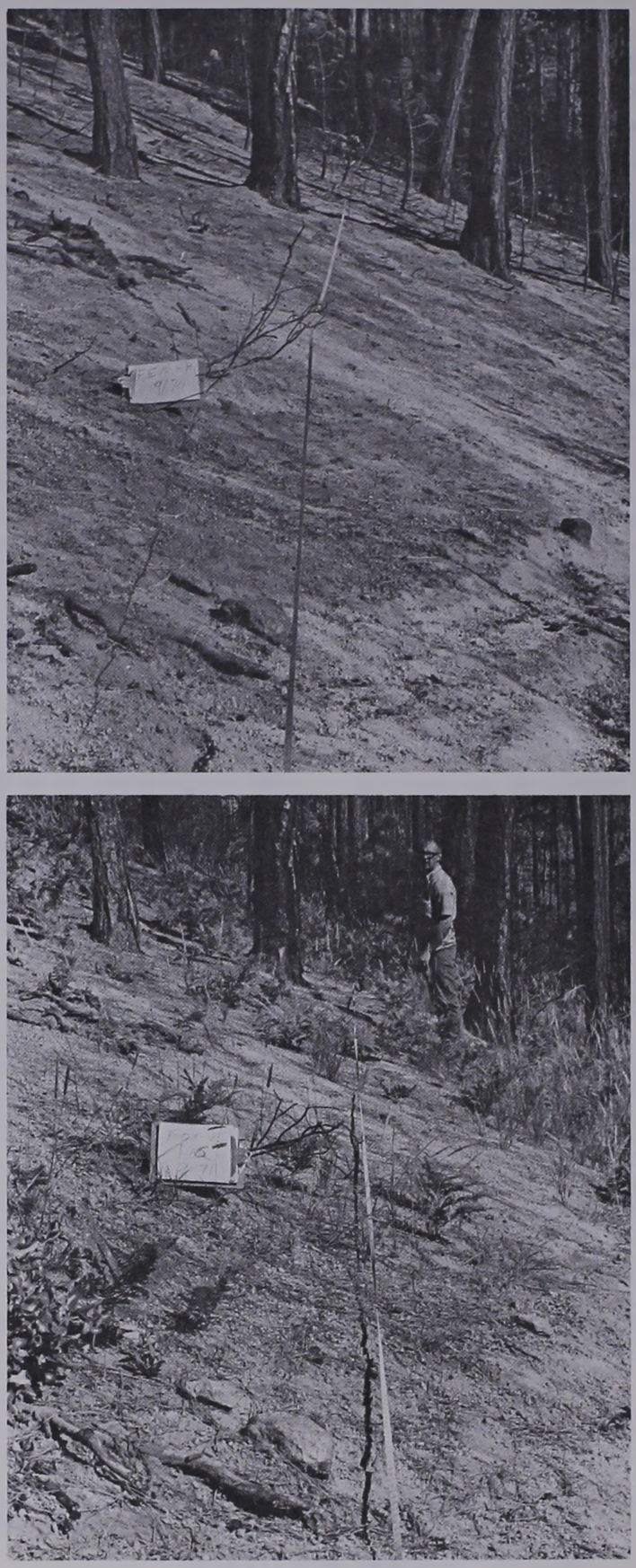


Photo at top shows permanent vegetation study transect on Fox Creek in September 1970. Lower photo shows the same area in August 1971. Fox Creek was neither reseeded nor fertilized.

RECREATION

(Publications on page 49)

Taped Presentations for Nature Trails

On the Restless Waters Nature Trail, Siuslaw National Forest, portable cassette tape players were compared with signs for effectiveness in interpreting the trail's attractions to visitors. Visitors who carried the tape players enjoyed the trail and remembered much more of the information presented than did visitors who had only signs for guidance.

Tests of different tapes showed that questions, used sparingly, can focus the visitor's attention and increase his retention of specific information.

A visitor to a nature trail using a tape player for explanation of the exhibits.

Values, Behavior, and Modern Camping Culture

Our studies indicate that recent converts to camping apparently find the highly developed, structured social setting of modern campgrounds consistent with their ideas of what camping is all about. Such satisfaction with today's outdoor recreation conditions may come as a surprise to many longtime recreationists and managers of recreation areas. However, newcomers to camping appear to be strongly influenced by urban behavior patterns and are not as sensitive to, nor demanding of, the more traditional, natural environment recreation standards held by many persons of longer experience.

This attitude on the part of today's new campers may pose a problem to land managers seeking to integrate rather highly structured camping opportunities with more traditional recreation uses and other forest management activities. The location and character of established modern campgrounds may be due to a process of creeping development in response to increasing use and demands of the modern camper. The result is often inappropriate location of what has become a highly developed recreation complex in the forest interior and displacement of the more nature-oriented recreationists to more primitive settings.

Highly developed campgrounds can meet modern camper needs and be located on the Forest or Park fringe where there are virtually unlimited opportunities for expansion without encroachment on areas more appropriate for nature-oriented recreation. Progressively natural-oriented recreation sites established along portals to the Forest interior would provide opportunity for campers to voluntarily select their desired degree of development or naturalness. A diverse range of outdoor recreation opportunities might thus be provided for campers who may increasingly seek more challenging outdoor camping experiences.

Incentive Approach to Litter Control

The incentive approach to litter control, previously developed by recreation research from experiments in movie theaters and a forest campground, was further tested for its operational feasibility compared with regular cleanup procedures. The incentive approach was used in part of a large developed campground, while normal cleanup procedures were used for litter control in the remainder. Results of this trial indicated that the incentive approach reduced litter levels ninefold below that achieved by normal procedures but cost only one-sixteenth as much. The cost per

30-gallon plastic bag of litter collected using the incentive approach was $.53, compared with $8.32 for usual procedures.

The incentive system produced equally dramatic results when applied to a dispersed car-camping area along a forest road and in a hiking area at Paradise in Mount Rainier National Park. Future plans call for testing the feasibility of the incentive approach to litter control on a wider geographic and administrative basis such as an entire National Forest.

Per-visitor Costs of Information Programs

Costs per National Forest visitor were compared for a variety of contact methods. In most cases, cost per contact depended more on number of visitors and operation and maintenance costs than on initial construction costs (as indicated by depreciation and interest). The highest cost per contact (87 cents) was for a rather lightly used amphitheater.

Cost estimates for potential contact methods indicate that a series of small radio transmitters—designed to play through the visitor's car radio as he drives along—could provide information at a lower cost per contact (10 cents) than such usual facilities as visitor centers (50 cents) and nature trails (28 cents).

REGENERATION

(Publications on page 50)

Cold Nights Influence Lodgepole and Ponderosa Pine Distribution

In the pumice soil region of south-central Oregon, abrupt boundaries between ponderosa and lodgepole pine stands frequently occur even with a slight change in topography. Usually, lodgepole pine is found in pure stands on flat topography, while ponderosa pine dominates the adjacent higher ground. Soil water tables and cold air drainage have both been suggested as factors controlling this distribution pattern.

We concluded that water tables had no differential influence on initial survival and growth of either species.

We found that the two species differed in tolerance to night minimum temperatures. When 6- to 8-day-old seedlings were subjected to minimum temperatures ranging from 12° to 23° F., greater mortality resulted for ponderosa pine.

These results indicate that distribution of lodgepole and ponderosa pine probably is related to occurrence of low night minimum temperatures during the germination period.

Protective Root Coatings

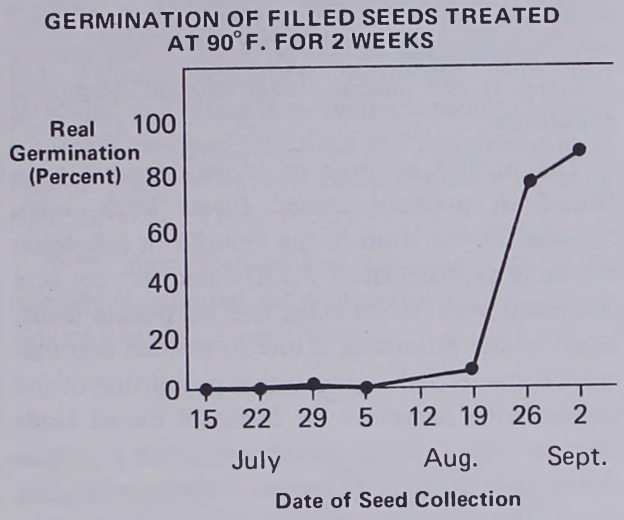
While out of the ground, roots of conifer nursery stock must be protected from desiccation. Moist sphagnum moss or other packing materials are often used to keep roots moist, but the protection provided isn't uniform throughout a bundle of trees. Roots might be better protected from desiccation during storage and planting by coating them with a moisture retaining material.

Three coating materials—clay slurry, sodium alginate, and xanthan gum—were tested during storage or exposure of Douglas-fir and noble fir seedlings. All three coatings satisfactorily protected seedling roots during 40 minutes' exposure to drying conditions in a growth chamber. Xanthan gum was best for Douglas-fir and clay slurry best for noble fir. None of the coatings proved as satisfactory as sphagnum moss for protecting seedling roots during 8 weeks of storage at 35° F.

Maturation of White Spruce Seeds in Interior Alaska

Collecting seeds from commercial species for artificial regeneration is time consuming and costly. Conifer cones must be collected during a rela-

tively short period of time—when seeds are mature but prior to natural dispersal. Our work with white spruce (*Picea glauca*) in interior Alaska revealed the following. White spruce seed generally mature around the first week in August. Seeds collected closer to the beginning of natural dispersal, which varies from mid-August to early September, are more vigorous and can withstand greater environmental stresses than can less mature seed. It is recommended that white spruce cones be collected no earlier than 2 weeks prior to natural seed dispersal.



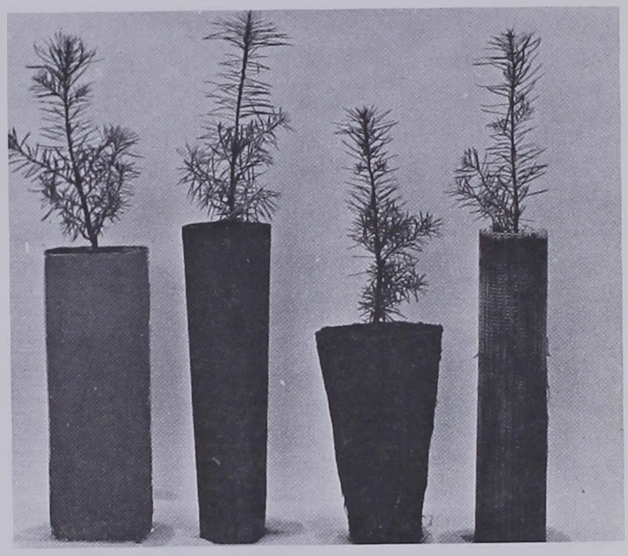
Containerized Nursery Stock

Development of systems for producing and planting containerized seedlings of uniform size and quality may increase success and flexibility of forest tree planting. Increased survival and faster initial growth loom large among benefits to be gained by using containerized stock. Such gains were realized when 1½-year-old Douglas-fir and noble fir nursery stock was potted, conditioned in coldframes for a few months, and outplanted in the Oregon Cascades.

First-season height growth of containerized trees averaged about 2½ times greater than that for comparable bare-root stock lifted directly from the nursery bed, and survival was also significantly higher. Containerized trees of both species were stockier and branched more by the end of the first season. Among the four types of containers being tested—quart-size milk cartons, 10-inch-long cardboard and plastic mesh tubes, and 7-inch peat pots—milk cartons appeared least beneficial. Succulent Douglas-firs withstood transplanting, or outplanting, better than succulent noble firs.

First-season survival and height growth of bare-root and containerized nursery stock

Type of stock	Survival	Height growth
	Percent	*Centimeters*
Douglas-fir:		
2-0 seedlings	82.8	2.9
1-1 transplants	84.0	2.8
Containerized	94.8	8.1
Noble fir:		
2-0 seedlings	70.4	1.8
1-1 transplants	85.4	2.3
Containerized	88.4	5.1



Field performance of Douglas-fir and noble fir nursery stock was determined following conditioning for several months in four types of containers (left to right)—quart-size milk carton, cardboard tube, pressed peat pot, and plastic mesh tube.

RESIDUES

(Publications on page 51)

Use and Value of Mill Residues Increasing

About 2.1 billion cubic feet of wood residues were produced in Washington, Oregon, and California primary manufacturing plants in 1970 (primary manufacturing is the conversion of round logs and bolts to products). The disposition of this residue is important because it represents a major source of raw material for pulp and board plants and because concern with air pollution has sharply constrained burning as a method of disposal for nonmarketable residues.

Long-term trends in residue use show an increase in the percent of total production that is used and a shift toward fiber product uses and away from fuel. In 1970, 87 percent of the coarse residues, 64 percent of the sawdust, 82 percent of the shavings, and 53 percent of the bark produced by primary manufacturing plants were destined for fiber products, fuel, or other miscellaneous uses. For comparison, only 58 percent of the coarse residues, which make up about half the total residue volume, were used in 1953.

Prices for pulpwood chips, the major use for residues, have also shown a long-term upward trend. During the 1960's, about $10 per 2,400-pound bone dry unit (BDU) was reported. Average prices reported by pulp-chip-using firms in 1971 are shown by geographic area:

	Type of mill	
	Kraft	Sulfite
	------- *Dollars* -------	
Puget Sound	20.00	28.00
Columbia River	22.75	25.25
Willamette Valley	20.50	–
Southwest Oregon	23.75	–
All areas	22.00	25.75

Residue Survey

We have documented the volume and characteristics of logging residues developed in Oregon, Washington, and California in 1969. A total of 900 million cubic feet of residue material, in pieces at least 4 inches in diameter, 4 feet long, and physically suitable for pulp chips, were produced. Over half of this, 465 million cubic feet, occurred in the Douglas-fir region. This is equivalent to half the total raw material consumption by the pulp, paper, and board industries in the region in 1969. Approximately 50 percent of the total chippable residue volume was in pieces over 12 inches in diameter, with over 60 percent of their gross volume chippable. However, most of this residue material is not usable under current economic conditions.

The highest volumes of logging residue were found in publicly owned forest lands, with National Forest lands in the Douglas-fir subregion averaging approximately 3,150 cubic feet per acre compared with 2,100 cubic feet on private lands. Much of the difference is due to the fact that old-growth stands make up a higher proportion of the stands being harvested on National Forest lands than on private lands. In the ponderosa pine subregion, logging residues are much lighter, averaging about 350 cubic feet per acre. Logging residues in California averaged 1,560 cubic feet per acre on private lands and 1,200 on National Forest lands, with the heavier volumes found in the redwood region of northern California.

Substantial volumes of chippable material are left in the woods as logging residues. Although economically unavailable at present, changing economic conditions, handling methods, and sales arrangements will bring more of this into use in the future.

SOILS, SITE, AND GEOLOGY

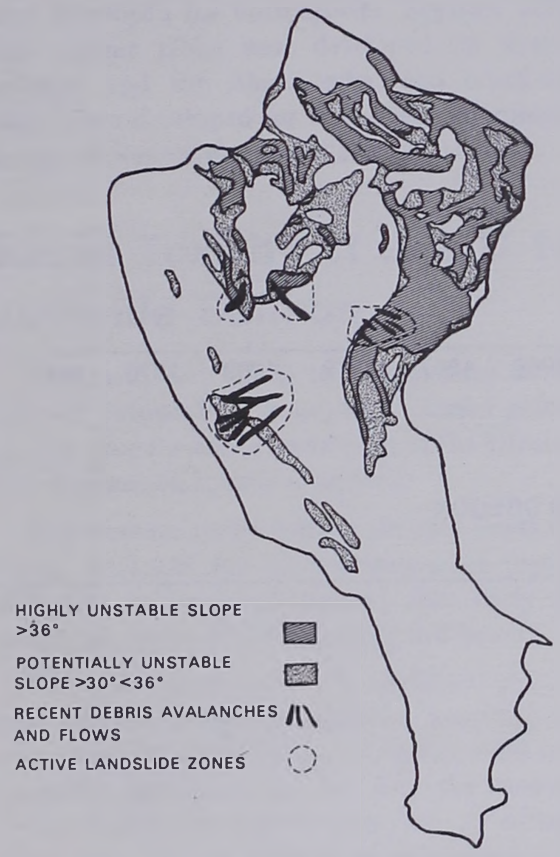
(Publications on page 51)

Land Stability Analysis

A practical technique designed to identify potentially unstable slopes and to provide at least a qualitative assessment of the degree of stability was developed and demonstrated by one of our watershed management staff on a 100,000-acre proposed timber sale near Petersburg, Alaska.

The sale area was stratified into "highly unstable," "potentially unstable," and "stable" zones, using isolines of equal slope. Areas of active and dormant soil mass movement were also identified and mapped, providing a means of locating immediate problem areas and designating local high-hazard areas within the potentially unstable zone.

Such identification and assessment of slope stability is essential for responsible land use planning on National Forest lands.



Timber Sale Area Stability Map, Petersburg, Alaska.

SUPPLY AND DEMAND

(Publications on page 52)

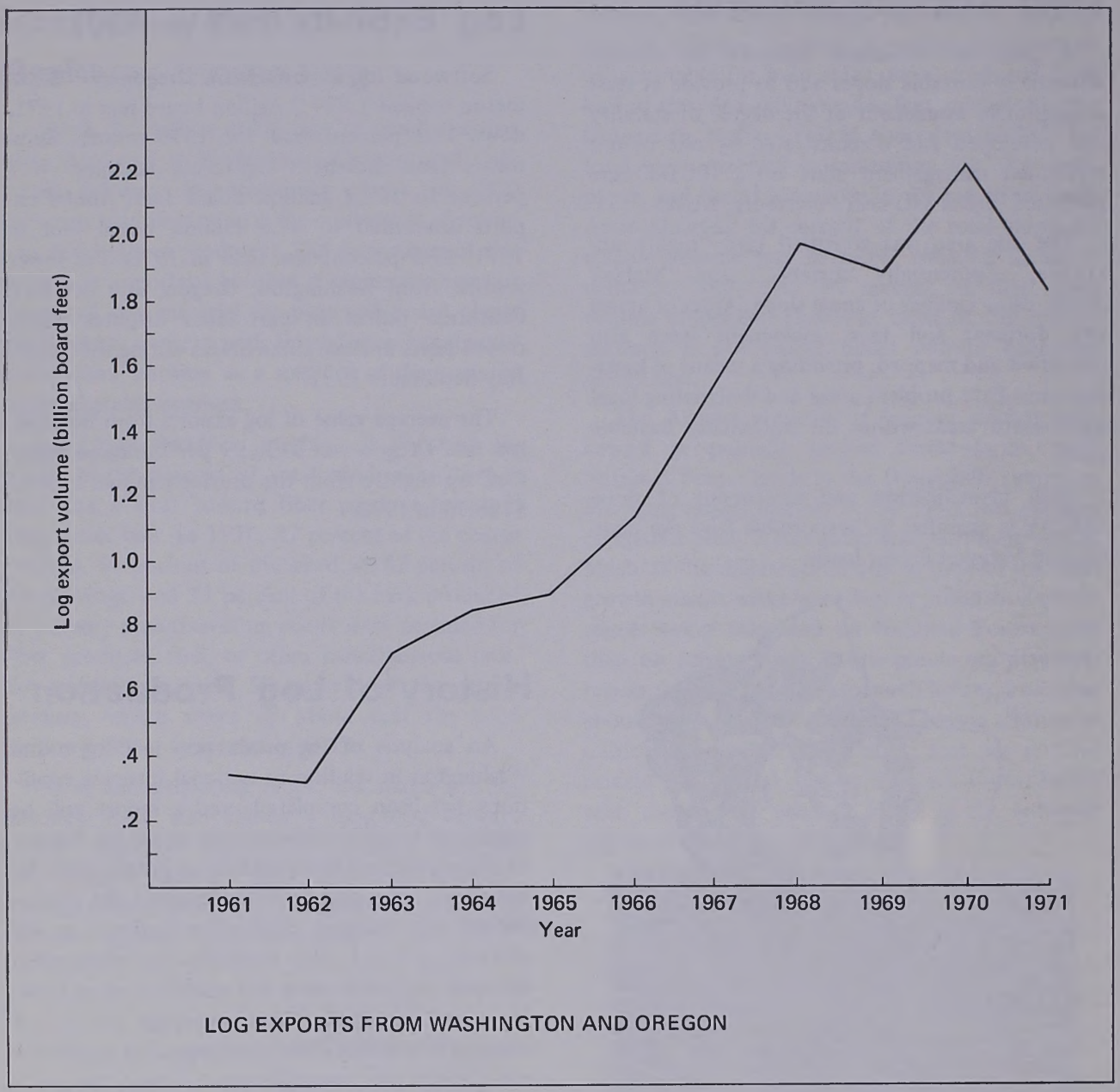
Log Exports Fall in 1971

Softwood log exports from Oregon and Washington totaled 1,837.2 million board feet in 1971, down 17.1 percent from the 1970 volume. Shipments from northern California declined 46.7 percent to 102.4 million board feet. Alaska exports amounted to 42.6 million board feet in 1971, 17.3 percent less than in 1970. The lower volume from Washington, Oregon, and northern California reflect in part labor disputes which closed ports in these three States during the period July-September 1971.

The average value of log exports from Washington and Oregon was $126.99 per thousand board feet, up slightly from the previous annual high of $126.76 in 1970.

History of Log Production

An analysis of log production in Oregon and Washington in relation to national business conditions has been completed, and a report will be published in 1972. This report traces the history of log production from public and private lands by half-State areas and analyzes some of the factors behind the changing production patterns in the different areas. It also examines the relationship between log production and such factors as housing starts, National Forest stumpage prices, and changes in yield of FHA mortgages. No significant relationship was found between annual changes in log production and changes in yield of FHA mortgages. However, the study indicates that annual changes in housing starts are significantly related to changes the following year in total timber harvest from all ownerships and to changes in National Forest stumpage prices for all species combined. Also, annual stumpage price changes were found to be positively and significantly related to annual changes in log production.



LOG EXPORTS FROM WASHINGTON AND OREGON

TIMBER MANAGEMENT

(Publications on page 52)

Cedar Volume Tables for Alaska

During the past few years, the value of Alaska-cedar and western redcedar has increased substantially; they now command an average round-log value higher than any other Alaskan species. Most of the cedar harvested in Alaska now comes from clearcutting of mixed stands for western hemlock and Sitka spruce pulp timber. There is virtually no local market in Alaska for cedar, but interest in possibilities for establishing local industries is increasing. Meanwhile, cedar is being exported in round-log form, mostly to Japan. This export amounted to some 9.6 million board feet during 1970.

Because of the need for a more accurate estimate of the cedar resource, new volume tables were developed for both species. Separate cubic-foot volume tables were developed for western redcedar and for Alaska-cedar, and board-foot tables were developed for both species combined. A copy of these tables is available on request.

Acute Toxicity of 2,4-D to Juvenile Salmon

Treatment with 2,4-D to control alder on 400 acres of cutover land in southeast Alaska pointed out the need for better knowledge of the effects of this chemical on aquatic organisms.

A laboratory study defined the safe limits of 3 esters of 2,4-D for several species of juvenile salmonids in southeast Alaska. This study also compared results of similar testing in Oregon.

The isocotyl ester of 2,4-D was found to be the least harmful to aquatic organisms, requiring concentrations of nearly 50 p.p.m. before substantial mortality occurred. By contrast, the isobutyl-normal butyl ester and the propylene glycol butyl ether ester caused mortalities at concentrations near 1 p.p.m.

Tests with the isocotyl ester as formulated by three different manufacturers did not show detectable differences in mortality of coho salmon fingerlings.

Similar tests done in Alaska and in Oregon using the same techniques and the same lots of chemicals showed that Alaskan fish in Alaskan water were possibly slightly more affected by the chemical than were Oregon fish.

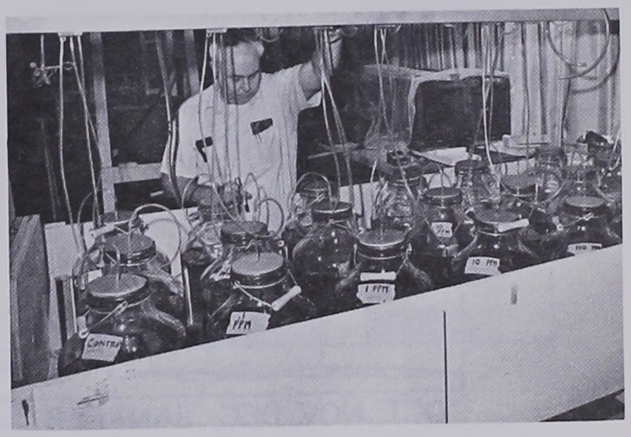
WATER QUALITY

(Publications on page 53)

Forest Fertilization and Nitrogen in Streamwater

Two recent studies show that only a very small fraction of the nitrogen applied in forest fertilizing enters streamwater. In southwestern Oregon, a 160-acre watershed was fertilized with urea at 200 pounds of nitrogen per acre. The total amount of fertilizer nitrogen found in the streamwater leaving the treated watershed in 1 year's time was 0.17 percent of the amount applied, or only 0.34 pounds of nitrogen per acre per year.

In eastern Washington, several watersheds were fertilized with urea and ammonium sulfate at the rate of 50 pounds of nitrogen per acre. Total nitrate lost during the peak runoff months ranged from 0.08 to 0.14 pound per acre.



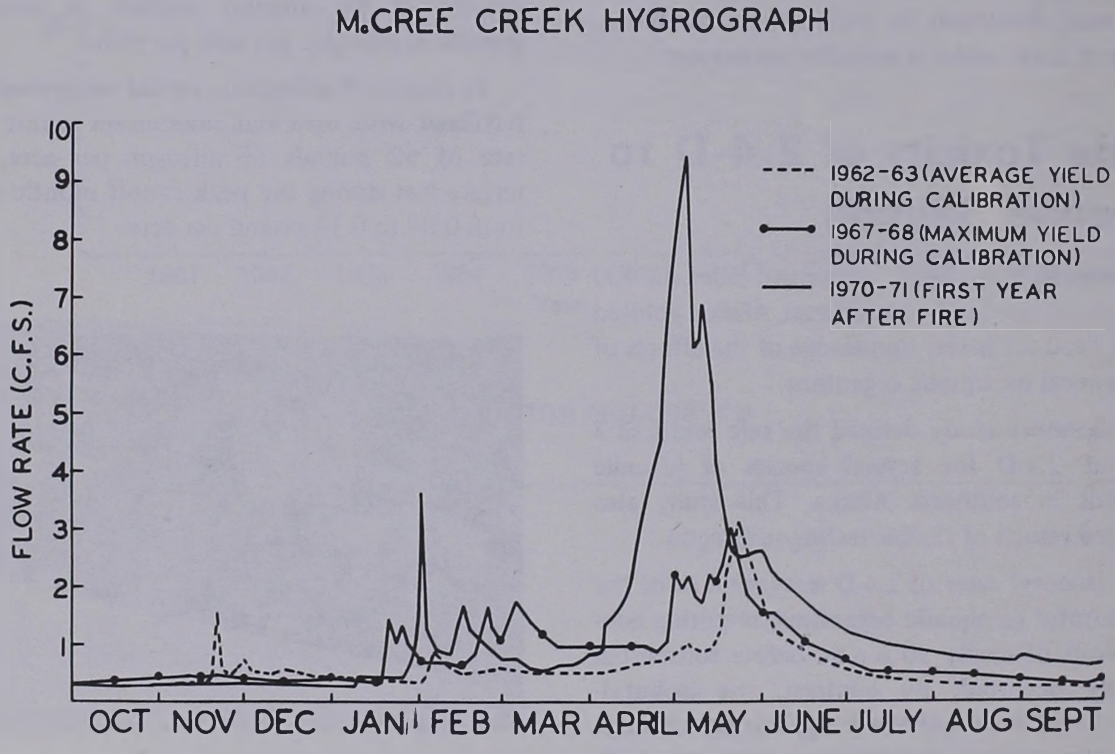
Static water bioassay set up for determining lethal concentrations of 2,4-D to young salmon.

In both studies, the loss of fertilizer nitrogen decreased to nearly zero by the end of the first year. These studies, together with other research we have conducted on fertilizer loss, indicate that forest fertilizing can be accomplished with minimum impact on streamwater chemistry.

Hydrologic Effects of Forest Fire

Each year forest fires consume many acres of forested land in the Pacific Northwest, but the effects of these fires on the hydrologic characteristics of the burned areas are largely unknown. Studies on the Entiat Experimental Watersheds, which were completely burned by wildfire in August 1970, have shown that forest fires can dramatically change streamflow and soil moisture storage. Immediately following the fire, diurnal oscillation of flow rate was reduced because the water-using vegetation along the streams was destroyed. At the same time, flow rates began to increase. A comparison of water yield for the first year after the fire with the maximum yield recorded prior to the fire showed that annual water yield increased as much as 70 percent as a result of the fire. Peak discharge during snowmelt increased greatly and occurred earlier than usual. Streamflow rates during the low flow months of August and September were approximately doubled as a result of the fire.

Measurements of soil moisture showed that, in the fall of 1971, the soil profile contained 4.5 inches more soil water than during the same period in 1970. As a result of this additional storage, it is expected that less precipitation input, mainly as snowmelt, will be required to start discharge into stream channels next spring than in the previous year.



Comparison of streamflow of McCree Creek following fire with the average and maximum streamflow observed during a 9-year calibration period before the fire.

WILDLIFE AND TIMBER

(Publications on page 53)

Deer and Douglas-fir Browsing

Browsing of Douglas-fir by black-tailed deer is responsible for reforestation delays in many plantations in the Pacific Northwest. To establish relationships between deer activity on an area and tree browsing, we counted deer pellet groups and examined young Douglas-fir trees for signs of browsing in 50 clearcuts ranging in age from 1 to 10 years.

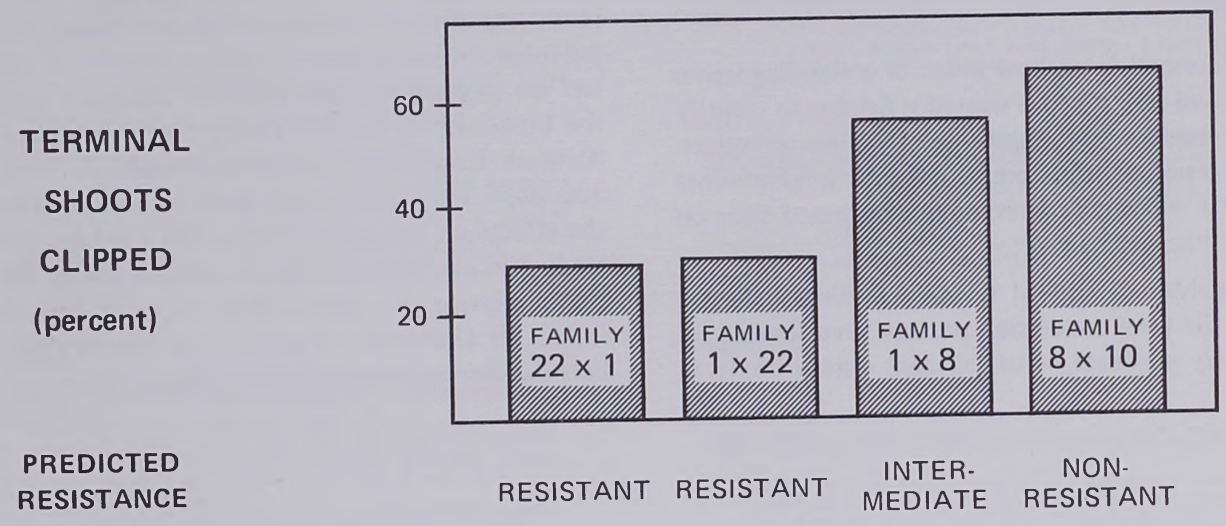
During the annual period from May 1967 through April 1968 and in the same interval in 1968-69, pellet group numbers were positively correlated with percentages of trees browsed. Extreme values for individual clearcuts ranged from no pellet groups and no trees browsed to 1,370 pellet groups per acre and 84 percent of trees browsed. We also found that browsing was highest during the 3 to 4 weeks following bud burst with a second but lower peak during the winter months.

The ability to predict levels of tree browsing resulting from given intensities of deer activity on an area should be valuable to both forest and game managers in setting mutually acceptable goals for tree growth and deer production. Delineation of peak periods of tree browsing will insure that research and operational efforts to control browsing by cultural methods will be directed toward protection at the proper times of year to attain maximum effectiveness.

Inherited Resistance to Hare Damage

We can now predict the susceptibility of Douglas-fir seedlings to damage by snowshoe hare on the basis of tree parentage. Previous work with Douglas-fir clones has shown that hare will discriminate consistently between genotypes. Moreover, the heritability of traits that govern this animal's highly selective preference for foliage of certain families is also evidently strong and under major gene control. Trials with captive animals have shown that progeny from controlled crosses will exhibit resistance that is both consistent with and predictable from the rated performance of parent trees.

Four Douglas-fir families exposed to heavy hare predation in field tests near Olympia, Washington, varied in damage to terminal shoots by more than 2 to 1 near the peak of winter feeding activity. After 30 weeks, the most resistant family was damaged 59 percent versus 86 percent for the least resistant. This work verifies that captive animals may be used to predict the relative resistance of seedlings planted in the field.



Eight weeks' damage by snowshoe hare to four Douglas-fir families as averaged from five plantations.

WOOD UTILIZATION

(Publications on page 54)

Improved Timber Grading Systems

The appraisal of standing timber for commercial sale requires an accurate estimate of the amount and value of lumber and/or veneer that can be produced from a given tract of timber. A good timber grading system should give reliable estimates of these end product yields.

New and improved timber grading systems were developed for coast-type Douglas-fir, western larch, and western white pine. New tree-log grades for predicting lumber and veneer yields were developed for old-growth coast Douglas-fir. This simplified four-grade system is more accurate and much easier to apply than the cumbersome and outdated seven-grade system presently used in timber sale cruising.

Tree grades that are similar in format to the Station's prediction equation successfully used for inland Douglas-fir were also developed for estimating larch and white pine lumber yields.

Utilization of Harvested Trees

Information on how much of a standing tree is used and how much is wasted is helping to identify opportunities for improved utilization practices. The resulting gains could increase total product output without a corresponding increased drain on the timber resource.

Analysis of current research findings indicates that the total conversion process from logging, to primary products, to use of plant residue results in as much as 86 percent of the total cubic-foot content of a tree being used. Logging efficiency is probably at an all-time high, with between 85 and 95 percent of the cubic-foot volume in a standing tree used. Neither sawmills nor plywood plants have made significant gains in processing of logs in recent years, with only 44 to 50 percent of a log converted to these primary products. Technological gains in equipment and processing have been largely offset by use of smaller logs of poorer quality. Current use of mill residues is extensive, with the pulp and board industries consuming 53 percent of all mill residues. Only 19 percent of total residues generated by all types of manufacturing plants remain unused.

Preservative Treatment of Alaskan Woods

The Station has collaborated with others in obtaining a test of preservative treatment of Alaskan woods for use as poles, piling, crossties, and treated lumber. Tests have shown that by using a double diffusion treatment process that does not require a pressure treating plant, penetration of preservatives can be obtained for four Alaskan species—white spruce, mountain hemlock, cottonwood, and Sitka spruce.

Although Alaskan woods are reputed to be hard to treat, the retention of preservatives in these four species was substantially greater than is currently specified for similar woods and indicates a potential for use as treated timbers. Results of this test are so gratifying that plans are underway with the University of Alaska's Institute of Agricultural Sciences Experiment Station at Palmer to treat 300 posts on a pilot study basis to demonstrate the effects on the useful life of posts. To date, this study has involved the cooperative efforts of the Forest Service, the Alaska State Forestry Department, the University of Alaska, the Forest Products Laboratory, and two private logging firms.

ANNOTATED LIST OF PUBLICATIONS BY GENERAL SUBJECTS-1971

THIS IS A LIST OF ALL PUBLICATIONS BY STATION STAFF AND COOPERATORS DURING THE YEAR 1971, INCLUDING PUBLISHED TALKS AND ADDRESSES (FEDERAL, STATE, OR PRIVATE COOPERATORS ARE INDICATED BY AN ASTERISK). AVAILABLE PUBLICATIONS MAY BE ORDERED BY THE FIVE-DIGIT NUMBER AT THE END OF AUTHOR LINE FROM PACIFIC NORTHWEST FOREST AND RANGE EXPERIMENT STATION, P.O. BOX 3141, PORTLAND, OREGON 97208.

ATMOSPHERE

FOWLER, W. B. 08 70200
PHOTORECORDING FOR TARGET INFORMATION AND READOUT STORAGE OF REMOTELY SENSED TEMPERATURE. (ABSTR.)
CONF. ON ELECTRON. INSTRUM. PROC. 1970, P. 117.
KEYWORDS. TEMPERATURE, REMOTE-SENSING, AERIAL PHOTOGRAPHY, THERMOMETERS.

FOWLER, W. B., AND H. W. BERNDT. 12 71152
EFFICIENCY OF FOLIAGE IN HORIZONTAL INTERCEPTION.
WEST. SNOW CONF. PROC., 1971, P. 27-33.
DIFFERENCES IN THE RATE OF RIME ACCUMULATIONS ARE A REFLECTION OF THE CHANGING EFFECTIVE SURFACE ACCOMPANYING SIMPLICATION OF FORM AND ENLARGEMENT OF RECEPTOR ELEMENTS. HEAT LOSS THROUGH FORCED CONVECTION APPEARS TO BE A MAJOR FACTOR IN CONDENSATICN GROWTH OF HOARFROST.
KEYWORDS. PRECIPITATION INTERCEPTION, FROST, WATERSHED MANAGEMENT.

FOWLER, WILLIAM B. 03 71013
MEASUREMENT OF SEASONAL AIR TEMPERATURES NEAR THE SOIL SURFACES.
J. RANGE MANAGE. 24, P. 158-160, ILLUS.
LARGE LOCAL DIFFERENCES APPEARED IN THE ONSET AND DURATION OF TEMPERATURE EXTREMES AS WELL AS ABSOLUTE SEASONAL MAXIMUM. PLANT COVER AND SOIL TYPE ARE MAJOR ELEMENTS ACCOUNTING FOR THIS LOCAL VARIATION.
KEYWORDS. SOIL TEMPERATURES, TEMPERATURE (SOIL).

BIOLOGICAL CONTROLS

MARTIGNONI, MAURO E., PAUL J. IWAI, AND JULIAN P. BREILLATT*. 11 71126
HETEROGENEOUS BUOYANT DENSITY IN BATCHES OF VIRAL NUCLEOPOLYHEDRA.
J. INVERTEBRATE PATHOL. 18, P. 219-226, ILLUS.
A STUDY OF THE BUOYANT DENSITIES AND COVARIANT PROPERTIES OF PREPARATIONS OF VIRAL NUCLEOPOLYHEDRA OBTAINED FROM LARGE VOLUMES OF TISSUE HOMOGENATES OF 'HEMEROCAMPA PSEUDOTSUGATA' LARVAE. THE DATA ARE INTENDED TO PROVIDE FURTHER CRITERIA FOR IMPROVING THE PURIFICATION OF POLYHEDRAL INCLUSION BODIES IN ANDERSON'S ZONAL ROTORS.
KEYWORDS. 'HEMEROCAMPA PSEUDOTSUGATA,' VIROLOGY, CENTRIFUGATION.

MASON, RICHARD R., AND C. G. THOMPSON. 1 71018
COLLAPSE OF AN OUTBREAK POPULATION OF THE DOUGLAS-FIR TUSSOCK MOTH, 'HEMEROCAMPA PSEUDOTSUGATA' (LEPIDOPTERA, LYMANTRIIDAE).
USDA FOREST SERV. RES. NOTE PNW-139, 10 P., ILLUS.
SURVIVORSHIP CURVES AND A PARTIAL LIFE TABLE WERE PREPARED WHICH ILLUSTRATE THE PATTERN AND GIVE THE CAUSES OF POPULATION DECLINE DURING THE FINAL SEASON OF A TUSSOCK MOTH OUTBREAK.
KEYWORDS. 'HEMEROCAMPA PSEUDOTSUGATA,' DOUGLAS-FIR TUSSOCK MOTH, 'ABIES CONCOLOR,' VIRUS DISEASES (INSECTS), FOREST INSECTS, INSECT POPULATIONS, MODOC NATIONAL FOREST, CALIF.

RYAN, ROGER B. 01 71026
INTERACTION BETWEEN TWO PARASITES, 'APECHTHIS ONTARIO' AND 'ITOPLECTIS QUADRICINGULATUS.' I. SURVIVAL IN SINGLY ATTACKED, SUPER-, AND MULTIPARASITIZED GREATER WAX MOTH PUPAE.
ANN. ENTOMOL. SOC. AMER. 64(1), P. 205-208.
OBSERVATIONS OF PARASITE ATTACK BEHAVIOR AND PROGENY SURVIVAL IN INDIVIDUAL WAX MOTH ('GALLERIA MELLONELLA' (L.)) PUPAE, SHOWED THAT 'APECHTHIS ONTARIO' (CRESSON), ALTHOUGH TENDING TO AVOID MULTIPARASITISM, IS SUPERIOR TO 'ITOPLECTIS QUADRICINGULATUS' (PROVANCHER).
KEYWORDS. PARASITISM, GREATER WAX MOTH, 'GALLERIA MELLONELLA,' 'APECHTHIS ONTARIO,' 'ITOPLECTIS QUADRICINGULATUS.'

RYAN, R. B., AND R. D. MEDLEY. 12 71153
REARING INSECT PARASITOIDS--A TECHNIQUE FOR COUNTING, SPACING, AND HOLDING LEPIDOPTEROUS PUPAE FOR PARASITIZATION.
J. ECON. ENTOMOL. 64, P. 1558, ILLUS.
PUPAE ARE COUNTED AND SPACED MECHANICALLY IN HOLES CUT IN A PLEXIGLAS TEMPLATE, AND HELD IN PLACE BETWEEN SHEETS OF CHEESECLOTH AND PAPER TOWEL STUCK TOGETHER WITH LAUNDRY STARCH. PARASITIZATICN IS ACHIEVED THROUGH THE CHEESECLOTH.
KEYWORDS. PARASITIC INSECTS, PUPAE, GREATER WAX MOTH, 'GALLERIA MELLONELLA.'

SARTWELL, CHARLES. 12 71160
THINNING PONDEROSA PINE TO PREVENT OUTBREAKS OF MOUNTAIN PINE BEETLE.
IN 'PRECOMMERCIAL THINNING OF COASTAL AND INTERMOUNTAIN FORESTS IN THE PACIFIC NORTHWEST,' WASH. STATE UNIV., P. 41-52, ILLUS.
SEVERITY OF BEETLE-CAUSED MORTALITY IS RELATED TO STAND DENSITY, WHICH INDICATES THAT THINNING OF DENSE STANDS WILL PREVENT BEETLE OUTBREAKS.
KEYWORDS. THINNING (TREES), INSECT CONTROL, PONDEROSA PINE, 'PINUS PONDEROSA,' MOUNTAIN PINE BEETLE, 'DENDROCTONUS PONDEROSAE,' BARK BEETLE, SCOLYTIDAE, FOREST IMPROVEMENT CUTTING.

TORGERSEN, TOROLF R. 07 71107
PARASITES OF THE WESTERN HEMLOCK LOOPER, 'LAMBDINA FISCELLARIA LUGUBROSA' (HULST), IN SOUTHEAST ALASKA.
PAN-PACIFIC ENTOMOL. 47, P. 215-219, ILLUS.
THE PUPAL PARASITES NAMED AND DESCRIBED ARE PROBABLY ONLY A PARTIAL LIST AS THE RECORDS ARE BASED ON A SINGLE SEASON'S WORK.
KEYWORDS. PARASITIC INSECTS, WESTERN HEMLOCK LOOPER, 'LAMBDINA FISCELLARIA LUGUBROSA.'

CHEMICALS

BARRETT, J. W., AND C. T. YOUNGBERG*. 12 70195
FERTILIZING PLANTED PONDEROSA PINE ON PUMICE SOILS.
IN 'REGENERATION OF PONDEROSA PINE' OREG. STATE UNIV. SYMP. PROC. 1969, P. 82-88, ILLUS.
THIS PAPER PRESENTS RESULTS OF FOUR FIELD EXPERIMENTS DESIGNED TO TEST THE GROWTH RESPONSE OF PLANTED PONDEROSA PINE TO SEVEN COMMERCIALLY AVAILABLE FERTILIZERS.
KEYWORDS. FERTILIZER RESPONSE (FOREST TREE), SEEDLINGS, PONDEROSA PINE.

BOLLEN, W. B., AND C. M. TU*. 06 71056
INFLUENCE OF ENDRIN ON SOIL MICROBIAL POPULATIONS AND THEIR ACTIVITY.
USDA FOREST SERV. RES. PAP. PNW-114, 4 P.
ENDRIN APPLIED TO SOIL AT RATES OF MORE THAN THREE TIMES THE MAXIMUM THAT MIGHT BE EXPECTED FROM APPLICATION OF ENDRIN-TREATED TREE SEED HAD NO APPRECIABLE EFFECT ON NUMBERS OF SOIL ORGANISMS OR ON AMMONIFICATION, NITRIFICATION, OR SULFUR OXIDATION. DECOMPOSITION OF SOIL ORGANIC MATTER WAS INCREASED SIGNIFICANTLY IN THE PRESENCE OF ENDRIN.
KEYWORDS. ENDRIN, SOIL MICROBIOLOGY, PESTICIDES, AERIAL TREE SEEDING.

CAROLIN, V. M., AND W. K. COULTER. 2 71009
TRENDS OF WESTERN SPRUCE BUDWORM AND ASSOCIATED INSECTS IN PACIFIC NORTHWEST FORESTS SPRAYED WITH DDT.
J. ECON. ENTOMOL. 64, P. 291-297, ILLUS.
BUDWORM NUMBERS IN SPRAYED AREAS REFLECTED TRENDS IN UNSPRAYED AREAS. PARASITISM OF SMALL LARVAE EITHER INCREASED SLIGHTLY OR WAS THE SAME, 1 OR 2 YEARS AFTER SPRAYING, PARASITISM OF LARGE LARVAE 1 YEAR AFTER SPRAYING WAS HIGH IN SOME AREAS. FOLLOWING RESUMPTION OF SPRAYING IN 1958, THREE ASSOCIATED DEFOLIATORS SHOWED MARKEDLY BETTER SURVIVAL THAN THE WESTERN BUDWORM.
KEYWORDS. WESTERN SPRUCE BUDWORM, 'CHORISTONEURA OCCIDENTALIS,' INSECT POPULATIONS, INSECT PARASITES, DDT, INSECT CONTROL, CASCADE RANGE, BLUE MOUNTAINS, OREG.

CROUCH, GLENN L., AND M. A. RADWAN. 12 71188
EVALUATION OF R-55 AND MESTRANOL TO PROTECT DOUGLAS-FIR SEED FROM DEER MICE.
USDA FOREST SERV. RES. NOTE PNW-170, 6P.
BIOASSAYS USING DEER MICE SHOWED THAT R-55, A THIOCARBAMATE DERIVATIVE, APPLIED AS 2- AND 5-PERCENT COATINGS WAS INEFFECTIVE IN REDUCING CONSUMPTION OF DOUGLAS-FIR SEED. AT 2-PERCENT, MESTRANOL, AN ANTI-FERTILITY CHEMICAL, REDUCED SEED CONSUMPTION TO LEVELS COMPARABLE WITH ENDRIN APPLIED AT THE CURRENT OPERATIONAL RATE OF 0.5 PERCENT.
KEYWORDS. SEED TREATMENT, MICE, BIOLOGICAL ASSAY, PESTICIDES.

GEIST, JON M. 12 71144
ORCHARDGRASS RESPONSES TO FERTILIZATION OF SEVEN SURFACE SOILS FROM THE CENTRAL BLUE MOUNTAINS OF OREGON.
USDA FOREST SERV. RES. PAP. PNW-122, 12 P., ILLUS.
ORCHARDGRASS RESPONSES TO N, P, AND S APPLIED SINGLY AND IN COMBINATION DIFFERED AMONG SEVEN SOILS STUDIED. DRY MATTER PRODUCTION SHOWED A SIGNIFICANT INTERACTION BETWEEN N AND S TREATMENTS IN ALL INSTANCES. ONLY TWO SOILS SHOWED A SIGNIFICANT RESPONSE TO PHOSPHORUS. LARGEST OVERALL TREATMENT RESPONSES WERE NOTED ON KLICKER AND VOLCANIC-ASH-DERIVED SOILS.
KEYWORDS. FERTILIZATION (PLANTS), SOIL FERTILITY, NITROGEN, SULPHUR.

GRATKOWSKI, H. 03 71028
GRASS AND FORB CONTROL IN DOUGLAS FIR PLANTATIONS.
IN 'RESEARCH PROGRESS REPORT,' WEST SOC. WEED SCI. 1971, P. 31. (NO COPIES AVAILABLE)
KEYWORDS. HERBICIDES, DOUGLAS-FIR.

GRATKOWSKI, H. 12 71194
MIDSUMMER FOLIAGE SPRAYS ON SALMONBERRY AND THIMBLEBERRY.
USDA FOREST SERV. RES. NOTE PNW-171, 5 P.
MIXTURES OF PICLORAM AND PHENOXY HERBICIDE AMINES WERE COMPARED WITH AMITROLE-T AND LOW VOLATILE ESTERS OF 2, 4,5-T IN MIDSUMMER FOLIAGE SPRAYS ON SALMONBERRY ('RUBUS SPECTABILIS' PURSH) AND THIMBLEBERRY ('RUBUS PARVIFLORUS' NUTT.). ESTERS OF 2,4,5-T WERE FOUND TO BE THE BEST HERBICIDE FOR FOLIAGE SPRAYS APPLIED DURING LATE JULY IN THE OREGON COAST RANGES.
KEYWORDS. HERBICIDES, SPRAYING, BRUSH CONTROL.

GRATKOWSKI, H. J. 12 70207
SEASONAL EFFECTS OF HERBICIDES ON NORTHWESTERN CONIFERS AND BRUSH SPECIES. (ABSTR.)
1970 PROC. OF WEST. SOC. OF WEED SCI. 23, P. 46.
RESULTS INDICATE THAT EARLY FALL MAY BE SUITABLE FOR APPLICATION OF AERIAL SPRAYS TO RELEASE PINES FROM BRUSH COMPETITION IN SOUTHWESTERN OREGON.
KEYWORDS. AERIAL BRUSH CONTROL, HERBICIDES.

KLOCK, G. O. 06 71061
FOREST EROSION CONTROL FERTILIZATION AND STREAMFLOW NITROGEN LOSS. (ABSTR.)
WEST. SOC. SOIL SCI. ANNU. MEET., 1971, P. 12. (NO COPIES AVAILABLE)
QUANTITIES OF UREA-N, NITRATE-N, AND AMMONIA-N LOSS THROUGH STREAMFLOW FOR A PERIOD OF 60 DAYS FOLLOWING FERTILIZATION OF THE ENTIAT EXPERIMENTAL WATERSHEDS ARE REPORTED.
KEYWORDS. FERTILIZATION, WATERSHED.

KLOCK, G. O. 11 71183
STREAMFLOW NITROGEN LOSS FOLLOWING FOREST EROSION CONTROL FERTILIZATION.
USDA FOREST SERV. RES. NOTE PNW-169, 9 P., ILLUS.
ESTIMATED QUANTITIES OF UREA-N, NITRATE-N, AND AMMONIA-N LOSS THROUGH STREAMFLOW FOR A PERICD OF 60 DAYS FOLLOWING FERTILIZATION OF WATERSHEDS ON THE ENTIAT EXPERIMENTAL FOREST SEVERELY AFFECTED BY WILDFIRE ARE REPORTED.
KEYWORDS. AERIAL FERTILIZATION, STREAMFLOW RECORDS, SOIL EROSION.

KLOCK, G. O., AND J. M. GEIST. 04 71035
SULFUR-COATED UREA AND ITS POSSIBLE USE IN EROSION CONTROL FERTILIZATION. (ABSTR.)
IN 'ABSTRACTS OF THE 1971 JOINT MEETINGS OF IDAHO ACADEMY OF SCIENCE-NORTHWEST SCIENTIFIC ASSOCIATION-WASHINGTON STATE ENTOMOLOGICAL SOCIETY.' (NO COPIES AVAILABLE)
KEYWORDS. NITROGEN FERTILIZERS, SOIL EROSION.

KLOCK, G. O., J. M. GEIST, AND A. R. TIEDEMANN. 09 71154
EROSION CONTROL FERTILIZATION--FROM POT STUDY TO FIELD TESTING.
SULPHUR INST. J. 7, P. 7-10, ILLUS.
FIELD EXPERIMENTATION WAS INITIATED IN CONJUNCTION WITH THE GREENHOUSE STUDY IN ORDER TO EVALUATE NITROGEN AND SULPHUR RELATIONS IN THE NATURAL ENVIRONMENT. SEEDING ALONG WITH A STARTER FERTILIZER WAS RECOMMENDED FOR SOME LOCATIONS. IN SOME AREAS SULPHUR AS WELL AS NITROGEN WAS RECOMMENDED.
KEYWORDS. SOIL-BINDING PLANTS, FERTILIZER ANALYSIS, SULPHUR, UREA.

MAKSYMIUK, BOHDAN. 10 71128
AERIAL APPLICATION OF HERBICIDES - PROBLEMS AND SOLUTIONS.
OREG. WEED CONF. PROC., 1971, P. 25-27.
IMPROVEMENTS IN AERIAL APPLICATION TECHNOLOGY WILL RESULT IN MAXIMUM PLANT COVERAGE WITH A MINIMUM DOSE, THUS MINIMIZING THE DRIFT AND RESIDUE PROBLEMS AND REDUCING COST.
KEYWORDS. HERBICIDES, AERIAL SPRAYING, HERBICIDE RESIDUES.

MAKSYMIUK, BOHDAN. 12 71180
HOW TO MINIMIZE DRIFT OF PESTICIDAL SPRAYS.
PESTICIDES, PEST CONTROL AND SAFETY ON FOREST LANDS PROC., 1971, OREG. STATE UNIV., CORVALLIS, P. 180-187.
DRIFT OF HERBICIDES AND INSECTICIDES POSES A PROBLEM OF TOXICITY TO NON-TARGET BIOTA AND RESIDUE PROBLEMS. THESE PROBLEMS CAN BE REDUCED AND/OR PREVENTED BY IMPROVING AERIAL APPLICATION TECHNOLOGY (SPRAY FORMULATION, ATOMIZATION, EQUIPMENT, METHOD OF APPLICATION, ETC.).
KEYWORDS. HERBICIDES, INSECTICIDES, PESTICIDE RESIDUES, AERIAL PEST CONTROL.

MAKSYMIUK, BOHDAN. 12 71179
KINETICS AND PHYSICS OF PESTICIDAL AERIAL SPRAYS.
PESTICIDES, PEST CONTROL AND SAFETY ON FOREST LANDS PROC., 1971, OREG. STATE UNIV., CORVALLIS, P. 171-179.
FACTORS AFFECTING TARGET COVERAGE (SPRAY FORMULATION, ATOMIZATION DEVICES, SPRAY ATOMIZATION, SWATH DEPOSIT PATTERNS, AERIAL APPLICATION METHODS) AND SPRAY DEPOSIT ASSESSMENT ARE DISCUSSED.
KEYWORDS. AERIAL PEST CONTROL.

MOORE, DUANE G. 12 71178
PRINCIPLES OF MONITORING.
PESTICIDES, PEST CONTROL AND SAFETY ON FOREST LANDS PROC., 1971, OREG. STATE UNIV., CORVALLIS, P. 155-168, ILLUS.
PESTICIDE MONITORING PROGRAMS ARE DESIGNED TO DETERMINE THE RELATIVE SAFETY OF FOREST MANAGEMENT PRACTICES THAT INTRODUCE PESTICIDE CHEMICALS INTO THE FOREST ENVIRONMENT. ACTUAL INSECT AND BRUSH CONTROL PROJECTS ARE USED AS EXAMPLES IN EXAMINING THE PROBLEMS OF PLANNING AND CONDUCTING A PESTICIDE MONITORING STUDY.
KEYWORDS. INSECTICIDE RESIDUES, HERBICIDE RESIDUES, PESTICIDE RESIDUES, ENVIRONMENT.

*NEWTON, MICHAEL, AND LOGAN A. NORRIS. 07 71081
DISAPPEARANCE OF 2,4,5-T FROM FOREST ECOSYSTEMS. (ABSTR.)
WEED SCI. SOC. AMER. ANNU. MEET., 1971, P. 29-30, (NO COPIES AVAILABLE)
SIGNIFICANT QUANTITIES OF HERBICIDE MAY NOT REACH TREATED AREAS DURING THE AERIAL APPLICATION OF 2,4,5-T TO FOREST LANDS. VOLATILIZATION, DEGRADATION, AND DOWNSTREAM MOVEMENT ARE IMPORTANT IN REDUCING THE LEVEL OF 2,4,5-T IN TREATED AREAS. THE PROPER USE OF 2,4,5-T POSES NEGLIGIBLE HAZARD TO THE INHABITANTS OF THE FOREST ENVIRONMENT.
KEYWORDS. ECOSYSTEM, FOREST ECOLOGY, HERBICIDE RESIDUE.

NORRIS, LOGAN A. 12 71177
THE BEHAVIOR OF CHEMICALS IN THE FOREST.
PESTICIDES, PEST CONTROL AND SAFETY ON FOREST LANDS PROC., 1971, OREG. STATE UNIV., CORVALLIS, P. 133-141, ILLUS.
THE BEHAVIOR OF A CHEMICAL RESULTS FROM THE INTERACTION BETWEEN THE PROPERTIES OF THE CHEMICAL AND THE ENVIRONMENT. CHEMICAL BEHAVIOR DETERMINES THE LIKELIHOOD OF EXPOSURE TO TARGET AND NONTARGET ORGANISMS. SAFE AND EFFECTIVE USE OF PESTICIDES CANNOT BE ASSURED WITHOUT AN UNDERSTANDING OF THE BEHAVIOR OF CHEMICALS IN THE ENVIRONMENT.
KEYWORDS. PESTICIDE RESIDUES, HERBICIDE RESIDUES, ECOLOGY.

NORRIS, LOGAN A. 10 71135
CHEMICAL BRUSH CONTROL--ASSESSING THE HAZARD.
J. FOREST. 69, P. 715-720, ILLUS.
IN NORMAL CHEMICAL BRUSH CONTROL OPERATIONS ON FOREST LANDS, RESIDUES OF 2,4-D, AMITROLE, 2,4,5-T, OR PICLORAM ARE NOT ACUTELY TOXIC TO MOST NONTARGET ORGANISMS. THE SHORT PERSISTENCE AND LACK OF ACCUMULATION OF THESE HERBICIDES IN FOOD CHAINS PRECLUDE CHRONIC EXPOSURE. RESEARCH AND A LONG HISTORY OF FIELD USE SHOW THESE HERBICIDES CAN BE USED WITH MINIMUM HAZARD.
KEYWORDS. HERBICIDES, BRUSH CONTROL, HERBICIDE RESIDUES, ECOSYSTEM.

NORRIS, LOGAN A. 10 71120
HERBICIDE ACTION IN THE FOREST. (ABSTR.)
SOC. AMER. FOREST. ANNU. MEETING, 1971 P. 5-6
(NO COPIES AVAILABLE)
KEYWORDS. HERBICIDES, FOREST MANAGEMENT.

NORRIS, LOGAN A. 12 71156
STUDIES OF THE SAFETY OF ORGANIC ARSENICAL HERBICIDES AS PRECOMMERCIAL THINNING AGENTS--A PROGRESS REPORT.
IN 'PRECOMMERCIAL THINNING OF COASTAL AND INTERMOUNTAIN FORESTS IN THE PACIFIC NORTHWEST,' WASH. STATE UNIV., P. 63-74.
A COOPERATIVE STUDY TO DETERMINE THE BEHAVIOR AND IMPACT OF THE ORGANIC ARSENICAL HERBICIDES IN THE FOREST ENVIRONMENT WAS INITIATED IN JUNE 1970. THIS PAPER REPORTS THE RESEARCH APPROACH TO EACH COOPERATIVE STUDY, SUMMARIZES, AND INTERPRETS THE LIMITED RESULTS TO DATE. THE KEY TO SAFE USE OF ORGANIC ARSENICALS APPEARS TO BE CAREFUL CONTROL OF HANDLING AND APPLICATION TO MINIMIZE EXPOSURE OF MAN AND ANIMALS.
KEYWORDS. HERBICIDES, ANIMALS, TOXICOLOGY, ECOSYSTEM.

PACIFIC NORTHWEST FOREST AND RANGE EXP. STN. 12 71187
BEHAVIOR AND IMPACT OF CHEMICALS ON THE FOREST ENVIRONMENT.
2 P., ILLUS.
THE FOLDER GIVES GENERAL INFORMATION ON PERSONNEL, NATURE OF THE STUDIES, PUBLICATIONS, AND ILLUSTRATIONS OF THE RESEARCH PROJECT.
KEYWORDS. CHEMICALS, ENVIRONMENT, RESEARCH, FOREST MANAGEMENT, ECOSYSTEM.

RADWAN, M. A., AND G. L. CROUCH. 04 71040
EFFECTS OF NURSERY FERTILIZATION WITH DIFFERENT FORMS OF NITROGEN ON GROWTH, CHEMICAL PROPERTIES, AND DEER BROWSING OF DOUGLAS-FIR SEEDLINGS. (ABSTR.)
IN 'ABSTRACTS OF THE 1971 JOINT MEETINGS OF IDAHO ACADEMY OF SCIENCE-NORTHWEST SCIENTIFIC ASSOCIATION-WASHINGTON STATE ENTOMOLOGICAL SOCIETY.' (NO COPIES AVAILABLE)
KEYWORDS. NITROGEN FERTILIZERS, DEER BROWSING, DOUGLAS-FIR.

RADWAN, M. A., G. L. CROUCH, AND H. S. WARD*. 05 71054
NURSERY FERTILIZATION OF DOUGLAS-FIR SEEDLINGS WITH DIFFERENT FORMS OF NITROGEN.
USDA FOREST SERV. RES. PAP. PNW-113, 8 P., ILLUS.
AMMONIUM SULFATE, CALCIUM NITRATE, AND UREA FERTILIZERS WERE TESTED IN THE NURSERY TO DETERMINE THE RELATIVE VALUES OF AMMONIUM, NITRATE, AND UREA AS NITROGEN SOURCES FOR DOUGLAS-FIR. SEEDLING GROWTH IN THE NURSERY AND OUTPLANTING PERFORMANCE OF THE FERTILIZED TREES WERE ESSENTIALLY THE SAME WITH THE NITRATE AND UREA, AND BOTH FERTILIZERS WERE SUPERIOR TO THE AMMONIUM.
KEYWORDS. FOREST NURSERY FERTILIZATION, DOUGLAS-FIR SEEDLINGS, AMMONIUM SULFATE, CALCIUM NITRATE, UREA, SURVIVAL, HEIGHT GROWTH, OVENDRY WEIGHT.

RADWAN, M. A., AND W. D. ELLIS. 09 71103
FACTORS AFFECTING ENDRIN CONTENT OF ENDRIN-COATED DOUGLAS-FIR SEED.
NORTHWEST SCI. 45(3), P. 188-192, ILLUS.
ENDRIN CONTENT OF COMMERCIALLY TREATED DOUGLAS-FIR SEED WAS AFFECTED BY TREATMENT, SOWING BY HELICOPTER, AND WEATHERING. EFFECTS MAY EXPLAIN FAILURES WITH ENDRIN-TREATED SEED AND INDICATE MEANS FOR IMPROVING THE TREATMENT.
KEYWORDS. AERIAL SEED PLANTING, PESTICIDES, ENDRIN, DOUGLAS-FIR, FOREST MANAGEMENT.

*SEARS, HOWARD S., AND WILLIAM R. MEEHAN. 09 71133
SHORT-TERM EFFECTS OF 2,4-D ON AQUATIC ORGANISMS IN THE NAKWASINA RIVER WATERSHED, SOUTHEASTERN ALASKA.
PESTICIDES MONITORING J. 5(2), P. 213-216, ILLUS.
THE FOREST SERVICE SPRAYED 2,4-D ON LOGGED-OFF LAND ON BARANOF ISLAND TO CONTROL RED ALDER. THERE WAS NO SIGNIFICANT IMMEDIATE MORTALITY TO SALMONID FISHES AND AQUATIC INSECTS. WATER AND FISH TISSUE SAMPLES SHOWED 2,4-D CONCENTRATIONS BELOW THOSE CONSIDERED LETHAL.
KEYWORDS. PESTICIDE RESIDUES, 2,4-D, AQUATIC ANIMALS.

STEWART, R. E. 03 71027
FIELD SCREENING OF FOLIAGE APPLIED HERBICIDES ON COAST RANGE BRUSH SPECIES. (ABSTR.)
IN 'RESEARCH PROGRESS REPORT,' WEST. SOC. WEED SCI. 1971, P. 29-30. (NO COPIES AVAILABLE)
KEYWORDS. HERBICIDES.

TARRANT, ROBERT F. 10 71119
NUTRIENT RELEASE IN STREAMFLOW FROM FOREST WATERSHEDS IN RELATION TO MANAGEMENT PRACTICE. (ABSTR.)
SOC. AMER. FOREST. ANNU. MEETING, 1971, P. 4.
(NO COPIES AVAILABLE)
KEYWORDS. NUTRIENT ELEMENTS (PLANTS), FOREST MANAGEMENT, STREAMFLOW.

TARRANT, ROBERT F. 12 71176
PERSISTENCE OF SOME CHEMICALS IN PACIFIC NORTHWEST FORESTS.
PESTICIDES, PEST CONTROL AND SAFETY ON FOREST LANDS PROC., 1971, OREG. STATE UNIV., CORVALLIS, P. 133-141, ILLUS.
'PERSISTENCE' IS THE TENDENCY OF A CHEMICAL COMPOUND TO REMAIN IN AN UNALTERED FORM. RESEARCH WITH SEVERAL ECONOMIC CHEMICALS IN PACIFIC NORTHWEST FORESTS INDICATES THAT PERSISTENCE DEPENDS ON A NUMBER OF ENVIRONMENTAL CONDITIONS AND CANNOT BE EXTRAPOLATED FROM EXPERIENCE IN OTHER AREAS.
KEYWORDS. INSECTICIDE RESIDUES, HERBICIDE RESIDUES, PESTICIDE RESIDUES, ECOLOGY.

ECONOMICS IN FOREST MANAGEMENT

*BEUTER, JOHN H. 08 71085
TIMBER VALUE-A MATTER OF CHOICE. A STUDY OF HOW END USE ASSUMPTIONS AFFECT TIMBER VALUES.
USDA FOREST SERV. RES. PAP. PNW-118, 13 P., ILLUS.
THE RELATIONSHIP BETWEEN ESTIMATED TIMBER VALUES AND ACTUAL TIMBER PRICES IS DISCUSSED. TIMBER VALUES ARE RELATED TO HOW, WHERE, AND WHEN THE TIMBER IS USED. AN ANALYSIS DEMONSTRATES THE RELATIVE VALUES OF A TYPICAL DOUGLAS-FIR STAND UNDER ASSUMPTIONS ABOUT TIMBER USE.
KEYWORDS. FOREST APPRAISAL, FORESTRY BUSINESS ECONOMICS.

FLORA, DONALD F. 12 70197
ECONOMICS AND POLICY ENVIRONMENTS FOR FOREST REGENERATION.
IN 'REGENERATION OF PONDEROSA PINE' OREG. STATE UNIV. SYMP. PROC. 1969, P. 62-68, ILLUS.
FOUR FOREST MANAGEMENT POLICY SITUATIONS ARE DISCUSSED. EACH PRESENTS A DIFFERENT KIND OF ECONOMIC QUESTION. ALTHOUGH TRADITIONAL ECONOMIC ANALYSES MAY INDICATE A RELATIVELY LOW RATE OF RETURN ON SOME FORESTRY INVESTMENTS, IN A CONTEXT OF SOCIAL OBJECTIVES THEY MAY BECOME HIGHLY ATTRACTIVE ECONOMICALLY.
KEYWORDS. FORESTRY BUSINESS ECONOMICS, REFORESTATION, ECONOMICS.

SCHALLAU, CON H. 05 71046
WHO SAYS ACCELERATED ROADBUILDING PAYS.
J. FOREST. 69, P. 279-280, ILLUS.
THREE STUDIES ARE SUMMARIZED WHICH DISCLOSE ACCELERATED ROAD CONSTRUCTION TO BE UNECONOMICAL FOR PUBLIC TIMBER PRODUCTION UNITS IN THE DOUGLAS-FIR REGION OF OREGON AND WASHINGTON. THESE FINDINGS SUGGEST THAT RECOMMENDATIONS 30, 33, AND 36 OF THE PUBLIC LAND LAW REVIEW COMMISSION REPORT ARE INCONSISTENT.
KEYWORDS. TIMBER MANAGEMENT, PUBLIC LANDS, FOREST MANAGEMENT, ROAD CONSTRUCTION, LAND ECONOMICS.

ECONOMICS IN WOOD INDUSTRY

GEDNEY, DONALD R., AND JOHN W. HENLEY. 07 71079
UTILIZATION ESTIMATES FOR WESTERN SOFTWOODS--TREES, LOGS, AND RESIDUE.
USDA FOREST SERV. RES. NOTE PNW-158, 8 P.
ESTIMATES OF THE EFFICIENCY OF THE WESTERN SOFTWOOD INDUSTRY IN UTILIZING THE WOOD FIBER VOLUME IN TREES ARE PROVIDED. LOGGING RESIDUE VOLUMES AND THE UTILIZATION OF RESIDUES ASSOCIATED WITH THE MANUFACTURE OF PLYWOOD AND LUMBER ARE CONSIDERED.
KEYWORDS. LOG UTILIZATION, RESIDUE VOLUME, LUMBER, PLYWOOD, RECOVERY RATIOS, WESTERN SOFTWOODS.

FIRE

BARNEY, RICHARD J. 07 71109
SELECTED 1966-69 INTERIOR ALASKA WILDFIRE STATISTICS WITH LONG-TERM COMPARISONS.
USDA FOREST SERV. RES. NOTE PNW-154, 13 P., ILLUS.
THIS PAPER PRESENTS SELECTED INTERIOR ALASKA FOREST AND RANGE WILDFIRE STATISTICS FOR THE PERIOD 1966-69. COMPARISONS ARE MADE WITH THE DECADE 1956-65 AND THE 30-YEAR PERIOD 1940-69, WHICH ARE ESSENTIALLY THE TOTAL RECORDED STATISTICAL HISTORY ON WILDFIRES AVAILABLE FOR ALASKA.
KEYWORDS. FOREST FIRES, RANGE BURNING, ALASKA.

BARNEY, RICHARD J. 12 71140
WILDFIRES IN ALASKA--SOME HISTORICAL AND PROJECTED EFFECTS AND ASPECTS.
IN 'FIRE IN THE NORTHERN ENVIRONMENT, A SYMPOSIUM,' C. W. SLAUGHTER, RICHARD J. BARNEY, AND G. M. HANSEN (EDS.). USDA FOREST SERV. PAC. NORTHWEST FOREST AND RANGE EXP. STA., PORTLAND, OREGON, P. 51-59.
THIS PAPER DISCUSSES SOME OF THE HISTORICAL ASPECTS OF WILDFIRES IN INTERIOR ALASKA WITH PARTICULAR REFERENCE TO THE PERIOD FROM 1940 TO THE PRESENT. SEVERAL SPECULATIONS ARE MADE ON THE BASIS OF RECENT RECORDS RELATIVE TO FIRE IMPACT OR EFFECTS. THE NEED TO OBTAIN QUANTITATIVE IMPACT INFORMATION IS ALSO DISCUSSED.
KEYWORDS. FIRE CONTROL, ENVIRONMENT, ALASKA.

BERNDT, H. W. 4 71025
EARLY EFFECTS OF FOREST FIRE ON STREAMFLOW CHARACTERISTICS.
USDA FOREST SERV. RES. NOTE PNW-148, 9 P., ILLUS.
A COMPARISON OF STREAMFLOW RECORDS FROM THREE SMALL MOUNTAIN STREAMS IN NORTH-CENTRAL WASHINGTON BEFORE, DURING, AND AFTER A SEVERE FOREST FIRE SHOWED IMMEDIATE EFFECTS OF DESTRUCTIVE BURNING. NO DRASTIC IMMEDIATE CHANGE IN STREAM TEMPERATURES WAS NOTED.
KEYWORDS. FOREST FIRE, ALTERATION OF FLOW, RIPARIAN WATER LOSS, DIURNAL DISTRIBUTION, EVAPOTRANSPIRATION, DEPLETION.

BERNDT, H. W. 04 71032
SOME IMMEDIATE EFFECTS OF FOREST FIRE ON FLOW CHARACTERISTICS OF THE ENTIAT EXPERIMENTAL WATERSHEDS. (ABSTR.)
IN 'ABSTRACTS OF THE 1971 JOINT MEETINGS OF IDAHO ACADEMY OF SCIENCE-NORTHWEST SCIENTIFIC ASSOCIATION-WASHINGTON STATE ENTOMOLOGICAL SOCIETY.' (NO COPIES AVAILABLE)
KEYWORDS. WATERSHED, FOREST FIRE EFFECTS, STREAMFLOW.

LUND, H. GYDE 11 71131
FUEL APPRAISAL SYSTEMS RESEARCH.
NORTHWEST FOREST FIRE COUNC. MEET. PROC., 1971, P. 62-68. (NO COPIES AVAILABLE)
THIS PAPER REPORTS THE PROGRESS TOWARD PROVIDING A FRAMEWORK FOR A UNIVERSAL CHARACTERIZATION OF FOREST FIRE FUELS AND A ECONOMICAL AND EFFICIENT RECONNAISSANCE AND MAPPING SYSTEM.
KEYWORDS. FOREST FUELS, FOREST FIRE RISK, FOREST FIRE CONTROL.

MURPHY, JAMES L. 12 70194
FOREST FIRE SCIENCES GRADUATE STUDIES. IN 'WESTERN FOREST FIRE CONDITIONS.'
61ST WEST. FOREST. CONF. PROC., 1970, N.P.
HIGHLY TRAINED FOREST FIRE MANAGERS WILL BE NEEDED TO PLAN, ANALYZE, ORGANIZE, AND MANAGE FUTURE FIRE CONTROL SYSTEMS. THE FIRST GRADUATE PROGRAM IN FOREST FIRE SCIENCE AND TECHNOLOGY HAS BEEN LOCATED AND DEVELOPED AT THE UNIVERSITY OF WASHINGTON.
KEYWORDS. FOREST FIRE SCIENCES (GRADUATE STUDIES), FOREST FIRE CONTROL, FOREST FIRE WARDENS.

NOSTE, NONAN V. 12 71141
A RELATIONSHIP BETWEEN NATIONAL FIRE DANGER RATING SYSTEM SPREAD INDEX AND TIME-OF-DAY IN INTERIOR ALASKA.
IN 'FIRE IN THE NORTHERN ENVIRONMENT, A SYMPOSIUM,' C. W. SLAUGHTER, RICHARD J. BARNEY, AND G. M. HANSEN (EDS.). USDA FOREST SERV. PAC. NORTHWEST FOREST AND RANGE EXP. STA., PORTLAND, OREGON, P. 121-128, ILLUS.
DAILY CYCLIC PATTERNS IN AIR TEMPERATURE, RELATIVE HUMIDITY, AND WIND SPEED CAUSE VARIATIONS IN FIRE BEHAVIOR. A RELATIONSHIP BETWEEN TIME-OF-DAY AND SPREAD INDEX WAS DEVELOPED FOR FOUR INTERIOR ALASKA STATIONS TO PREDICT DIURNAL FLUCTUATION IN FIRE DANGER FOR PLANNING FIRE CONTROL OPERATIONS.
KEYWORDS. FIRE CONTROL, ENVIRONMENT, ALASKA.

*SLAUGHTER, C. W., RICHARD J. BARNEY, AND G. M. HANSEN. 12 71139
FIRE IN THE NORTHERN ENVIRONMENT--A SYMPOSIUM.
USDA FOREST SERV. PAC. NORTHWEST FOREST AND RANGE EXP. STA., 275 P., ILLUS. PORTLAND, OREG.
THE PROCEEDINGS INCLUDES PAPERS EXPLORING MANY ASPECTS OF WILDFIRE IN THE ALASKAN SUBARCTIC, ITS RELATIONSHIP TO NATURAL ENVIRONMENT, AND ITS CONTROL.
KEYWORDS. FIRE CONTROL, ENVIRONMENT, ALASKA.

*TRIGG, WILLIAM M. 12 71101
FIRE SEASON CLIMATIC ZONES OF MAINLAND ALASKA.
USDA FOREST SERV. RES. PAP. PNW-126, 12 P., ILLUS.
CALCULATED VALUES OF PRECIPITATION EFFECTIVENESS INDEX AND TEMPERATURE EFFICIENCY INDEX FOR 48 WEATHER OBSERVATION STATIONS ON THE ALASKA MAINLAND DELINEATE AREAS THAT HAVE DIFFERENT CLIMATIC SUBCLASSIFICATIONS DURING THE WILDFIRE SEASON OF APRIL THROUGH SEPTEMBER. USES ARE SUGGESTED.
KEYWORDS. CLIMATOLOGY, FIRE PREVENTION.

*WILSON, CARL C., AND JOHN D. DELL. 08 71097
THE FUELS BUILDUP IN AMERICAN FORESTS--A PLAN OF ACTION AND RESEARCH.
J. FOREST 69, P. 471-475, ILLUS. (NO COPIES AVAILABLE)
THIS PAPER DESCRIBES SOME OF THE MORE CONSPICUOUS PROBLEMS OF FUEL BUILDUP, EVALUATES WHAT CAN BE DONE ABOUT THEM WITH OUR PRESENT KNOWLEDGE, AND OUTLINES HIGH-PRIORITY RESEARCH NEEDS.
KEYWORDS. FOREST FIRE PREVENTION, FOREST FUELS, FOREST FIRES, FOREST MANAGEMENT.

GENERAL

BARNEY, RICHARD J., AND THOMAS C. VAN WICKLE*. 11 71148
A 'BATTERY SAVER' FOR EVENT RECORDERS.
USDA FOREST SERV. RES. NOTE PNW-168, 6 P., ILLUS.
AN ELECTRONIC CIRCUIT AND DEVICE DESIGNED TO ELIMINATE SOME OF THE PROBLEMS ENCOUNTERED WITH EVENT RECORDERS IN FIELD OPERATIONS IS DESCRIBED.
KEYWORDS. MEASURING EQUIPMENT, TRANSDUCERS, ELECTRIC BATTERIES.

*DITTRICH, WILLIAM J., AND JAMES M. TRAPPE. (EDS.) 03 70208
NATURAL AREAS--NEEDS AND OPPORTUNITIES.
NORTHWEST SCI. ASS. FORTY-THIRD ANNU. MEET. SYMP. PROC. 1970, 54 P. (NO COPIES AVAILABLE)
THESE PROCEEDINGS INCLUDE 14 PAPERS BY LAND MANAGERS, EDUCATORS, AND RESEARCHERS, PLUS A KEYNOTE ADDRESS BY A PROFESSIONAL STAFFMAN OF THE U. S. CONGRESS. THE PHILOSOPHY, STATUS, NEEDS, PROBLEMS, AND OPPORTUNITIES OF NATURAL AREAS ARE COMPREHENSIVELY PRESENTED.
KEYWORDS. WILDERNESS AREAS, FOREST CONSERVATION, ENVIRONMENT, WILDLIFE MANAGEMENT, RECREATION.

FRANKLIN, JERRY F. 12 70205
RESEARCH NATURAL AREAS IN THE PACIFIC NORTHWEST.
MAZAMA 1970, P. 29-34, ILLUS.
THE ADMINISTERING AGENCIES, PURPOSES, USES, SIZES, AND LOCATIONS OF 42 RESEARCH NATURAL AREAS IN OREGON AND WASHINGTON ARE DISCUSSED.
KEYWORDS. WILDERNESS AREA, FOREST MANAGEMENT.

GUY, WALLACE C. 09 71094
EYE IN THE SKY.
PROF. PHOTOGR. 98(1912), P. 147-150.
A MASTER PHOTOGRAPHER OUTLINES HISTORY AND DISCUSSES TECHNIQUES OF AERIAL PHOTOGRAPHY.
KEYWORDS. AERIAL PHOTOGRAPHY, PHOTOGRAMMETRY, PHOTOGRAPHY.

NEWLON, CHARLES J. 10 71129
REPORT OF ACTIVITIES, U.S. FOREST SERVICE PACIFIC NORTHWEST FOREST AND RANGE EXPERIMENT STATION.
FORTY-NINTH ANNU. WASH. STATE FOREST. CONF., 1970, P. 39-45, ILLUS.
HIGHLIGHTS RECENT AND EARLY DAY FOREST SERVICE RESEARCH ACTIVITIES IN THE STATE OF WASHINGTON. ANNOUNCES NEW MULTIFUNCTIONAL RESEARCH PROGRAM--FOREST RESIDUES REDUCTION SYSTEMS--TO BE HEADQUARTERED IN SEATTLE.
KEYWORDS. FOREST MANAGEMENT, WOOD WASTE, SLASH, FOREST FIRE CONTROL, LITTER (PUBLIC PLACES).

PACIFIC NORTHWEST FOREST AND RANGE EXP. STA. 06 71057
ANNOTATED LIST OF PUBLICATIONS OF THE PACIFIC NORTHWEST FOREST AND RANGE EXPERIMENT STATION FOR THE YEAR 1970.
13 P.
KEYWORDS. FORESTRY BIBLIOGRAPHY.

PACIFIC NORTHWEST FOREST AND RANGE EXP. STA. 4 71021
ANNUAL REPORT 1970.
56 P., ILLUS.
A SUMMARY OF THE STATION'S ACCOMPLISHMENTS FOR THE CALENDAR YEAR 1970. RESULTS IN A WIDE RANGE OF RESEARCH AREAS ARE PRESENTED IN HIGHLIGHT FORM.
KEYWORDS. FORESTRY RESEARCH.

PACIFIC NORTHWEST FOREST AND RANGE EXP. STA. 02 71001
LIST OF AVAILABLE PUBLICATIONS, NO. 1 1971.
2 PP., WITH ANNOTATIONS.
KEYWORDS. FORESTRY BIBLIOGRAPHY.

PACIFIC NORTHWEST FOREST AND RANGE EXP. STA. 5 71023
LIST OF AVAILABLE PUBLICATIONS, NO. 2 1971.
4 P., WITH ANNOTATIONS.
KEYWORDS. FORESTRY BIBLIOGRAPHY.

PACIFIC NORTHWEST FOREST AND RANGE EXP. STA. 5 71072
LIST OF AVAILABLE PUBLICATIONS, NO. 3 1971.
4 P., WITH ANNOTATIONS.
KEYWORDS. FORESTRY BIBLIOGRAPHY.

PACIFIC NORTHWEST FOREST AND RANGE EXP. STA. 09 71095
LIST OF AVAILABLE PUBLICATIONS, NO. 4 1971.
4 P., WITH ANNOTATIONS.
KEYWORDS. FORESTRY BIBLIOGRAPHY.

PACIFIC NORTHWEST FOREST AND RANGE EXP. STA. 12 71138
LIST OF AVAILABLE PUBLICATIONS, NO. 5 1971.
4 P., WITH ANNOTATIONS.
KEYWORDS. FORESTRY BIBLIOGRAPHY.

GENETICS

COPES, DONALD L. 12 69196
EXTERNAL DETECTION OF INCOMPATIBLE DOUGLAS-FIR GRAFTS.
INT. PLANT PROPAGATORS' SOC. COMB. PROC. 19, P. 97-102, ILLUS.
THE RELATIONSHIP BETWEEN DELAYED VEGETATIVE BUD DEVELOPMENT AND INTERNAL GRAFT INCOMPATIBILITY WAS CHECKED IN 116 DOUGLAS-FIR CLONES. OF 191 GRAFTS LABELED DELAYED, 184 WERE ANATOMICALLY INCOMPATIBLE. STAGE OF BUD DEVELOPMENT CAN BE USED BY SEED ORCHARDISTS TO INCREASE THE PERCENT COMPATIBILITY ACHIEVED IN THE ORCHARDS.
KEYWORDS. GRAFTING, DOUGLAS-FIR.

COPES, DONALD L. 05 71070
INTERSTOCK TRIALS WITH GRAFTED COASTAL DOUGLAS-FIR.
USDA FOREST SERV. RES. NOTE PNW-151, 6 P.
SEVENTEEN CLONES OF COASTAL DOUGLAS-FIR WERE TESTED AS INTERSTOCKS BETWEEN INCOMPATIBLE COASTAL SCIONS AND ROOTSTOCKS. THE INTERSTOCK METHOD WAS JUDGED UNSUCCESSFUL BECAUSE ONLY 22 PERCENT OF THE DOUBLE-GRAFTED RAMETS WERE COMPATIBLE. A PROBABLE FORM OF INDUCED INCOMPATIBILITY WAS DETECTED IN MANY SCION-INTERSTOCK UNIONS.
KEYWORDS. INTERSTOCK, GRAFTING, COMPATIBILITY, INCOMPATIBILITY.

COPES, DONALD L. 12 71161
SEED SOURCE AND GRAFT COMPATIBILITY IN DOUGLAS-FIR.
FOREST SCI. 17, P. 499.
NO EVIDENCE OF GEOGRAPHIC VARIATION IN PROPORTION OF COMPATIBLE GRAFTS WAS FOUND IN 6- TO 12-YEAR-OLD TREES GROWN FROM SEED COLLECTED IN 10 WESTERN STATES AND BRITISH COLUMBIA. VARIATION IN PROPORTION OF COMPATIBLE GRAFTS WITHIN AREAS OF A STATE WAS NEARLY AS LARGE AS THAT FOUND BETWEEN AREAS OF DIFFERENT STATES.
KEYWORDS. PLANT GRAFTING, DOUGLAS-FIR, SEED SOURCE.

PACIFIC NORTHWEST FOREST AND RANGE EXP. STA. 11 71146
BREEDING PACIFIC NORTHWEST TREES.
2 P., ILLUS.
THE FOLDER GIVES GENERAL INFORMATION ON PERSONNEL, NATURE OF THE STUDIES, PUBLICATIONS, AND ILLUSTRATIONS OF THE RESEARCH PROJECT.
KEYWORDS. PLANT GENETICS, TIMBER MANAGEMENT, RESEARCH, PACIFIC NORTHWEST.

SILEN, ROY R. 12 70198
THE SEED SOURCE QUESTION FOR PONDEROSA PINE.
IN 'REGENERATION OF PONDEROSA PINE' OREG. STATE UNIV. SYMP. PROC. 1969, P. 22-25.
OBSERVATIONS OF THE VARIATION FOUND IN THE NATURAL STAND OF PONDEROSA PINE, AND DATA FROM SEVEN STUDIES 25-55 YEARS OLD, SUGGEST THAT LOCAL SEED IS A BALANCE OF BEST GROWTH THAT CAN BE SUSTAINED AGAINST LONG TIME ENVIRONMENTAL EXTREMES. NONLOCAL SEED CARRIES NONACCEPTABLE RISKS WITH PRESENT KNOWLEDGE OF PERTINENT FACTORS.
KEYWORDS. SEED PLANTING, FOREST SEED ANALYSIS, PONDEROSA PINE.

SILEN, ROY R., AND KENNETH E. ROWE*. 09 71116
INHERITANCE OF STOCKINESS IN PONDEROSA PINE FAMILIES.
USDA FOREST SERV. RES. NOTE PNW-166, 12 P., ILLUS.
IN A STUDY OF 41 FAMILIES, STOCKY AND SLENDER PARENT TREES USUALLY PRODUCED CORRESPONDINGLY STOCKY OR SLENDER PROGENY.
KEYWORDS. TREE GENETICS, PONDEROSA PINE, TREE DIAMETER MEASUREMENT.

SORENSEN, FRANK. 11 71190
ESTIMATE OF SELF-FERTILITY IN COASTAL DOUGLAS-FIR FROM INBREEDING STUDIES.
SILVAE GENETICA 20, P. 115-120, ILLUS.
SELF-FERTILITY WAS GENERALLY LOW, WITH THE MEDIAN TREE YIELDING 7.5 PERCENT AS MANY SEEDS FOLLOWING SELF- AS FOLLOWING CROSS-POLLINATION. THERE SHOULD NOT BE MUCH PRODUCTION OF SELFED SEED UNDER NATURAL CONDITIONS EVEN IF NATURAL SELF-POLLINATION IS FOUND TO BE QUITE COMMON. THE MAJOR EFFECT OF LOW SELF-FERTILITY WILL PROBABLY BE A REDUCTION IN SEED SET.
KEYWORDS. FERTILIZATION (PLANTS), POLLINATION, DOUGLAS-FIR.

SORENSEN, FRANK C. 04 71084
'WHITE SEEDLING'--A PIGMENT MUTATION THAT AFFECTS SEED DORMANCY IN DOUGLAS-FIR.
J. HERED. 62(2), P. 127-130.
PAPER DESCRIBES DOUGLAS-FIR WHITE SEEDLING MUTANT. SEEDS CONTAINING THIS MUTANT APPEARED TO LACK ANY STRATIFICATION REQUIREMENT AND GERMINATED MORE RAPIDLY UNDER SEVERAL COMBINATIONS OF STRATIFICATION TEMPERATURE AND LENGTH.
KEYWORDS. PIGMENTS (PLANT), SEED DORMANCY, DOUGLAS-FIR, SEED GERMINATION.

SORENSEN, FRANK C., AND ROBERT K. CAMPBELL. 02 71044
CORRELATION BETWEEN DATES OF FLORAL AND VEGETATIVE BUD FLUSH IN DOUGLAS-FIR.
USDA FOREST SERV. RES. NOTE PNW-143, 4 P., ILLUS.
CORRELATION BETWEEN DATES OF FLORAL AND VEGETATIVE BUD FLUSH WAS NONSIGNIFICANT FOR 23 TREES. COEFFICIENT OF DETERMINATION WAS 0.17.
KEYWORDS. BUD BURST, 'PSEUDOTSUGA MENZIESII.'

INSECTS

CAROLIN, V. M., JR. 01 71024
EXTENDED DIAPAUSE IN 'COLORADIA PANDORA' BLAKE.
PAN-PAC. ENTOMOL. 47, P. 19-23.
DIAPAUSE OF PANDORA MOTH PUPAE REMAINING IN THE SOIL AFTER MOTH FLIGHT LASTED AS LONG AS 5 YEARS. SOME EMERGENCE FROM THESE PUPAE OCCURRED IN EACH OF THE 5 YEARS. PUPAL SURVEYS FOR PREDICTING ABUNDANCE OF FEEDING LARVAE SHOULD TAKE EXTENDED DIAPAUSE INTO ACCOUNT.
KEYWORDS. PANDORA MOTH, 'COLORADIA PANDORA,' INSECT BEHAVIOR, INSECT PESTS.

CAROLIN, V. M., DATERMAN, G. E., AND COULTER, W. K. 12 71168
TECHNIQUES IN OBTAINING OVERWINTERING LARVAE OF EUROPEAN PINE SHOOT MOTH FOR MASS REARING.
J. OF ECON. ENTOMOL. 64, P. 1408-1410.
TECHNIQUES WERE DEVELOPED FOR FORCING OVERWINTERING LARVAE OF 'RHYACIONIA BUOLIANA' (SCHIFFERMULLER) FROM INFESTED SHOOTS AND AVOIDING LARVAL TRANSPORT OF MOLDS INTO REARING DISHES.
KEYWORDS. INSECT REARING, LARVAE, EUROPEAN PINE SHOOT MOTH.

HARD, J. S. 07 71091
EFFECTS OF SEMISTARVATION DURING LATE LARVAL STAGES ON SURVIVAL AND FECUNDITY OF THE HEMLOCK SAWFLY.
USDA FOREST SERV. RES. NOTE PNW-157, 8 P., ILLUS.
SEMISTARVATION OF LATE-INSTAR LARVAE, DUE TO FEEDING ON CURRENT YEAR'S FOLIAGE RATHER THAN ON THE NORMAL DIET OF PREVIOUS YEAR'S FOLIAGE, CAUSED A 65-PERCENT REDUCTION IN SURVIVAL OF FEMALES VERSUS 10 PERCENT IN MALES AND A 26-PERCENT REDUCTION IN FECUNDITY OF SURVIVING FEMALES.
KEYWORDS. ENTOMOLOGY, LARVAE, HEMLOCK SAWFLY, 'NEODIPRION TSUGAE,' WESTERN HEMLOCK, 'TSUGA HETEROPHYLLA.'

HARD, J. S. 2 71022
SEQUENTIAL SAMPLING OF HEMLOCK SAWFLY EGGS IN SOUTHEAST ALASKA.
USDA FOREST SERV. RES. NOTE PNW-142, 9 P., ILLUS.
HEMLOCK SAWFLY EGG POPULATION CONCENTRATIONS ARE CLASSIFIED RAPIDLY THROUGH EXAMINATION OF BRANCH SAMPLES FROM TREES SELECTED RANDOMLY IN SEQUENCE. PERCENT OF TREES WHOSE BRANCH SAMPLES BEAR ONE OR MORE EGGS DETERMINES EGG POPULATION CONCENTRATION.
KEYWORDS. 'NEODIPRION TSUGAE,' HEMLOCK SAWFLY, SEQUENTIAL SAMPLING, INSECT POPULATIONS.

MITCHELL, R. G. 12 70204
INSECTS IN THE YOUNG STAND OF DOUGLAS-FIR AND HEMLOCK.
MANAGE. OF YOUNG GROWTH DOUGLAS-FIR AND WEST. HEMLOCK, SYMP. PROC. 1968, P. 47-51, ILLUS., OREG. STATE UNIV., CORVALLIS.
THE FORESTER MUST LOOK AT THE WHOLE ENVIRONMENT AND CONSIDER ALL SPECIES AS INTERACTING POPULATIONS--BECOME LESS OF AN ENGINEER AND MORE OF AN ECOLOGIST.
KEYWORDS. DOUGLAS-FIR, WESTERN HEMLOCK, INSECTS, FOREST INSECTS.

SARTWELL, CHARLES. 11 71137
'IPS PINI' (COLEOPTERA, SCOLYTIDAE) EMERGENCE PER EXIT HOLE IN PONDEROSA PINE THINNING SLASH.
ANN. ENTOMOL. SOC. AMER. 64(6), P. 1473-1474.

RATIO OF EMERGED 'IPS PINI' BEETLES TO EXIT HOLES IN PONDEROSA PINE THINNING SLASH RANGED FROM 1.2 TO 1.5 AND AVERAGED 1.3 NEW ADULTS PER EXIT HOLE IN SEVEN CAGED REARINGS.
KEYWORDS. BARK BEETLE, PONDEROSA PINE.

SARTWELL, CHARLES, R. F. SCHMITZ*, AND W. J. BUCKHORN. 07 71113
PINE ENGRAVER, IPS PINI, IN THE WESTERN STATES.
U.S. DEP. AGR. FOREST PEST LEAFL. 122, 5 P., ILLUS.
COVERS HOSTS, DAMAGE DESCRIPTION, LIFE HISTORY, AND NATURAL CONTROL.
KEYWORDS. BARK BEETLES, PINE ENGRAVER, IPS PINI, INSECT CONTROL.

SCHMIDT, FRED H., AND C. L. YOUNG. 05 71055
LARVAL COLORATION IN 'CHORISTONEURA' SPP. (LEPIDOPTERA, TORTRICIDAE). BILE PIGMENT IN HAEMOLYMPH.
J. INSECT PHYSIOL. 17, P. 843-855, ILLUS.
LARVAL HEMOLYMPH COLORATION IN 'CHORISTONEURA' SPP. IS DUE TO THE PRESENCE OF YELLOW AND BLUE CHROMOPROTEINS WHICH CAN BE RESOLVED BY GEL FILTRATION. THE PROSTHETIC GROUP OF THE BLUE CHROMOPROTEIN IS A BILITRIENE-TYPE BILE PIGMENT AS DETERMINED BY A COMPARISON OF SOME OF ITS PHYSICO-CHEMICAL PROPERTIES.
KEYWORDS. CHROMOPROTEINS, LARVAE, INSECTS, 'CHORISTONEURA' SPP., BILE PIGMENTS.

WICKMAN, BOYD E., GALEN C. TROSTLE*, AND PAUL E. BUFFAM*. 6 71099
DOUGLAS-FIR TUSSOCK MOTH.
U.S. DEP. AGR. FOREST PEST LEAFL. 86 (REV.), 6 P., ILLUS.
IN NONTECHNICAL LANGUAGE, THIS IMPORTANT DEFOLIATOR OF TRUE FIRS AND DOUGLAS-FIR IS DESCRIBED, AND NATURAL CONTROLS ARE DISCUSSED.
KEYWORDS. INSECT CONTROL, PEST CONTROL, DEFOLIATION, DOUGLAS-FIR TUSSOCK MOTH, 'HEMEROCAMPA PSEUDOTSUGATA.'

LOGGING

CARSON, WARD W., AND CHARLES N. MANN. 10 71118
AN ANALYSIS OF RUNNING SKYLINE LOAD PATH.
USDA FOREST SERV. RES. PAP. PNW-120, 9 P., ILLUS.
THE MATHEMATICS OF A SIMPLIFIED APPROACH TO RUNNING SKYLINE PROBLEMS IS PRESENTED, AND THE SIMPLIFIED SOLUTION IS COMPARED WITH THE EXACT CATENARY SOLUTION. THIS APPROACH ALLOWS PRACTICAL DESIGN OF RUNNING SKYLINES WITH DESK-TOP COMPUTER/PLOTTERS.
KEYWORDS. CABLE LOGGING, MATHEMATICAL ANALYSIS, LOGGING, SKIDDING (CABLEWAY), COMPUTER.

CARSON, WARD W., AND PENN A. PETERS. 06 71078
GROSS STATIC LIFTING CAPACITY OF LOGGING BALLOONS.
USDA FOREST SERV. RES. NOTE PNW-152, 17 P.
THE FUNDAMENTALS OF AEROSTATICS AS THEY APPLY TO LOGGING BALLOONS ARE DISCUSSED. NOMOGRAPHS ARE PROVIDED TO INDICATE THE DEPENDENCE OF BALLOON LIFT UPON ATMOSPHERIC CONDITIONS. THIS INFORMATION CAN BE USED BY BALLOON LOGGERS TO MONITOR GAS LOSS AND STUDY BALLOON PERFORMANCE DURING OPERATION.
KEYWORDS. BALLOON LOGGING, AERIAL LOGGING, LOGGING, LOGGING EQUIPMENT.

CARSON, WARD W., DONALD STUDIER*, AND HILTON H. LYSONS. 06 71077
RUNNING SKYLINE DESIGN WITH A DESK-TOP COMPUTER/PLOTTER.
USDA FOREST SERV. RES. NOTE PNW-153, 21 P., ILLUS.
A DESK-TOP COMPUTER IS USED FOR DETERMINING THE FEASIBILITY OF A RUNNING SKYLINE. THE COMPUTER PLOTS THE PROFILE AND LOAD PATH FOR A GIVEN LOAD. A LOGGING SYSTEM DESIGNER CAN OBTAIN RESULTS AND MAKE ANY NECESSARY MODIFICATIONS WITHOUT THE DELAYS INHERENT IN THE LARGER COMPUTER SYSTEMS.
KEYWORDS. SKYLINE LOGGING, LOGGING OPERATIONS, COMPUTER PROGRAMS, LOGGING.

ROTHACHER, JACK. 08 71173
REGIMES OF STREAMFLOW AND THEIR MODIFICATION BY LOGGING.
FOREST LAND USES AND STREAM ENVIRON. SYMP. PROC. 1970, P. 40-54, ILLUS.
THERE IS NO GREAT INCREASE IN MAJOR 'WET MANTLE' FLOOD FLOWS TO LOGGING IN WEST SLOPE FORESTS. LOGGING WHICH REMOVES TRANSPIRING VEGETATION INCREASES LOWEST SUMMER STREAMFLOW. SUCH INCREASES MAY BE SHORT LIVED AS VEGETATION RAPIDLY INVADES THE CUTOVER AREAS.
KEYWORDS. STREAMFLOW RECORDS, TIMBER HARVEST, LOGGING.

MENSURATION

CURTIS, ROBERT O. 06 71067
A TREE AREA POWER FUNCTION AND RELATED STAND DENSITY MEASURES FOR DOUGLAS-FIR.
FOREST SCI. 17, P. 146-159, ILLUS.
EXPRESSIONS FOR A NUMBER OF ALTERNATIVE STAND DENSITY MEASURES WERE DERIVED AND NUMERICAL VALUES OF THESE MEASURES COMPARED FOR DOUGLAS-FIR STANDS. A SIMPLE SUM OF DIAMETERS TO A SUITABLE POWER PROVIDED THE SIMPLEST OF SEVERAL DIAMETER-BASED MEASURES OF STAND DENSITY AND IS SHOWN TO BE LOGICALLY AND PRACTICALLY EQUIVALENT TO A NUMBER OF OLDER AND GENERALLY ACCEPTED MEASURES.
KEYWORDS. STOCKING, COMPETITION, 'PSEUDOTSUGA MENZIESII.'

CURTIS, ROBERT O. 12 71162
BOOK REVIEW OF 'THE PRINCIPLES OF FOREST YIELD STUDY,' BY ERNST ASSMANN.
FOREST SCI. 17, P. 498. (NO COPIES AVAILABLE)
KEYWORDS. FOREST MEASUREMENT, FOREST MANAGEMENT, FOREST CUTTING SYSTEMS, THINNING (TREES), STAND INCREMENT ESTIMATE, STAND YIELD TABLES.

DIPPOLD, RONALD M., AND WILBUR A. FARR. 04 71052
VOLUME TABLES AND EQUATIONS FOR WHITE SPRUCE, BALSAM POPLAR, AND PAPER BIRCH OF THE KUSKOKWIM RIVER VALLEY, ALASKA.
USDA FOREST SERV. RES. NOTE PNW-147, 8 P., ILLUS.
VOLUME TABLES AND EQUATIONS WERE DERIVED FROM A SAMPLE OF TREES FROM THE KUSKOKWIM RIVER VALLEY. CUBIC-FOOT TABLES WERE DEVELOPED FOR WHITE SPRUCE, PAPER BIRCH, AND BALSAM POPLAR. BOARD-FOOT TABLES, INTERNATIONAL 1/4-INCH AND SCRIBNER RULES, WERE PREPARED FOR WHITE SPRUCE.
KEYWORDS. VOLUME TABLES, VOLUME EQUATIONS, WHITE SPRUCE, BALSAM POPLAR, PAPER BIRCH, KUSKOKWIM RIVER VALLEY, ALASKA.

FARR, WILBUR A., AND VERNON J. LABAU. 09 71143
VOLUME TABLES AND EQUATIONS FOR OLD-GROWTH WESTERN REDCEDAR AND ALASKA-CEDAR IN SOUTHEAST ALASKA.
USDA FOREST SERV. RES. NOTE PNW-167, 18 P.
SEPARATE CUBIC-FOOT VOLUME TABLES ARE GIVEN FOR WESTERN REDCEDAR ('THUJA PLICATA' DONN) AND ALASKA-CEDAR ('CHAMAECYPARIS NOOTKATENSIS' (D. DON) SPACH). BOARD-FOOT TABLES ARE GIVEN FOR BOTH SPECIES COMBINED.
KEYWORDS. TREE VOLUME TABLES, TREE VOLUME MEASUREMENT, WESTERN REDCEDAR, ALASKA-CEDAR.

HERMAN, FRANCIS R. 1 71003
A RATCHET WRENCH AND CLEANING EQUIPMENT FOR INCREMENT BORERS.
J. FOREST. 69, P. 26-27, ILLUS.
A RATCHET ASSEMBLY AND CLEANING EQUIPMENT FOR SMALL-DIAMETER INCREMENT BORERS FACILITATES BORING LARGE-DIAMETER TREES.
KEYWORDS. FOREST MEASUREMENT, TREE DIAMETER MEASUREMENT.

JOHNSON, FLOYD A., JAMES B LOWRIE*, AND MARTIN GOHLKE*. 09 71117
3P SAMPLE LOG SCALING.
USDA FOREST SERV. RES. NOTE PNW-162, 15 P., ILLUS.
AN APPLICATION OF THE 3P SAMPLE SELECTION PROCEDURE TO SAMPLE LOG SCALING IS DESCRIBED IN THIS REPORT ALONG WITH RESULTS FROM THREE TESTS. THE METHOD LOOKS PROMISING FOR SOME SITUATIONS, AND IT MAY PROVE SUPERIOR TO THE SAMPLE LOG SCALING METHODS NOW IN USE.
KEYWORDS. LOG SCALING, SAMPLE DESIGNS (FORESTRY), TIMBER ESTIMATING, DEFECT DEDUCTION (MERCHANTABLE VOLUME), FOREST MEASUREMENT.

LUND, H. GYDE. 1 71019
MIRROR STEREOSCOPE PARALLAX WEDGE.
USDA FOREST SERV. RES. NOTE PNW-140, 5 P., ILLUS.
MODIFICATION OF A CONVENTIONAL PARALLAX WEDGE FOR USE WITH A MIRROR STEREOSCOPE IS DESCRIBED.
KEYWORDS. PHOTOGRAMMETRY, AERIAL PHOTOGRAPHY, PARALLAX, MENSURATION, PHOTO INTERPRETATION.

PONG, W. Y., AND G. H. JACKSON*. 08 71088
DIAGRAMING SURFACE CHARACTERISTICS OF TRUE FIR LOGS.
PAC. NORTHWEST FOREST AND RANGE EXP. STA., 7 P., ILLUS.
SINCE THE LOG DIAGRAMING GUIDE FOR WESTERN SOFTWOODS WAS FIRST PUBLISHED IN 1963, CERTAIN CHANGES AND SUPPLEMENTAL INFORMATION TO THE GUIDE HAVE BEEN FOUND THAT WOULD FACILITATE FUTURE STUDIES OF LOG AND TREE CHARACTERISTICS. THE CHANGES CONCERN DIAGRAMING SURFACE AND END CHARACTERISTICS OF LOGS AND TREES. INSTRUCTIONS FOR DIAGRAMING TRUE FIR LOG CHARACTERISTICS ARE DESCRIBED IN DETAIL.
KEYWORDS. LOG DIAGRAM RULES, FOREST MEASUREMENT, LOGS, LOG DEFECT INDICATORS.

REUKEMA, DONALD L. 03 71014
CONSIDERATIONS AND PROBLEMS IN DETERMINING VOLUME GROWTH OF INDIVIDUAL TREES.
IN 'CONTRIBUTIONS TO INCREMENT RESEARCH.' INT. UNION FOREST RES. ORGAN. CONGR. MITT. FORSTL. VERSUCHSANST. 91, P. 11-32, ILLUS.
DISPROPORTIONATE RATES OF RADIAL INCREMENT, OUT-OF-ROUNDNESS OF TREE STEMS, AND IRREGULAR VARIATIONS IN BARK THICKNESS CAN BE MAJOR SOURCES OF ERROR IN DETERMINING PAST VOLUME GROWTH OF INDIVIDUAL DOUGLAS-FIR TREES. WHERE ACCURATE DETERMINATION OF PAST GROWTH OF INDIVIDUAL TREES IS NEEDED, IT CAN PROBABLY BE OBTAINED ONLY THROUGH NUMEROUS, ACCURATE MEASUREMENTS ON FELLED OR CLIMBED TREES.
KEYWORDS. TREE VOLUME MEASUREMENT, FOREST MEASUREMENT, TREE DIAMETER MEASUREMENT.

*SPADA, BENJAMIN, AND ROBERT B. POPE. 3 71015
ESTIMATING INCREMENT FOR INDIVIDUAL TREES ON THE U.S. FOREST SURVEY.
IN 'CONTRIBUTIONS TO INCREMENT RESEARCH.' INT. UNION FOREST RES. ORGAN. CONGR. MITT. FORSTL. VERSUCHSANST. 91, P. 55-68.
DESCRIBES THE NEEDS OF THE U.S. FOREST SURVEY FOR DATA ON THE GROWTH OF TREES AND FOREST STANDS, THE PROBLEMS ENCOUNTERED IN ESTIMATING GROWTH, AND THE NEED FOR FURTHER RESEARCH IN GROWTH ESTIMATION METHODS.
KEYWORDS. TREE INCREMENT ESTIMATES, TREE INCREMENT MEASUREMENT, FOREST MEASUREMENT.

PATHOLOGY

AHO, PAUL E. 08 71083
DECAY OF ENGLEMANN SPRUCE IN THE BLUE MOUNTAINS OF OREGON AND WASHINGTON.
USDA FOREST SERV. RES. PAP. PNW-116, 16 P., ILLUS.
DISSECTIONS OF 292 ENGELMANN SPRUCE FROM SEVEN AREAS IN THE BLUE MOUNTAINS PROVIDED DEFECT DATA. VARIATIONS IN DEFECT AMONG AREAS, RELATION OF DEFECT WITH TREE AGE AND SIZE, FUNGI ASSOCIATED WITH DECAY, AND THEIR INFECTION COURTS ARE DISCUSSED. TWO METHODS FOR ESTIMATING DEFECT IN STANDING TREES ARE GIVEN.
KEYWORDS. DECAY FUNGI (WOOD), DEFECT INDICATORS (WOOD QUALITY), FUNGI (FOREST DAMAGE).

CHILDS, T. W., AND E. E. NELSON. 2 71006
LAMINATED ROOT ROT OF DOUGLAS-FIR.
U.S. DEP. AGR. FOREST PEST LEAFL. 48 (REV.), 7 P., ILLUS.
NO PRACTICAL METHOD OF DIRECT CONTROL IS KNOWN OR FORESEEABLE, BUT LOSSES CAN OFTEN BE REDUCED BY APPROPRIATE MANAGEMENT PRACTICES.
KEYWORDS. ROT (ROOT), 'PORIA WEIRII,' DISEASES, FUNGI, DOUGLAS-FIR.

CHILDS, T. W., KEITH R. SHEA, AND JAMES L. STEWART*. 2 71005
ELYTRODERMA DISEASE OF PONDEROSA PINE.
U.S. DEP. AGR. FOREST PEST LEAFL. 42 (REV.), 6 P., ILLUS.
EVALUATIONS SHOULD BE MADE IN SPRING OR EARLY SUMMER WHEN INFECTION IS MOST APPARENT. DAMAGE CAN BE REDUCED BY MAINTAINING THRIFTY YOUNG STANDS AND SALVAGING THREATENED MATURE TREES BEFORE THEY DIE.
KEYWORDS. 'ELYTRODERMA DEFORMANS,' 'PINUS PONDEROSA,' NEEDLE BLIGHT (PINUS), TREE DISEASES, FUNGUS DISEASES.

*FURMAN, THOMAS E., AND JAMES M. TRAPPE. 09 71150
PHYLOGENY AND ECOLOGY OF MYCOTROPHIC ACHLOROPHYLLOUS ANGIOSPERMS.
QUART. REV. BIOL. 46, P. 219-225.
A COMPARISON OF THE DEGREE OF MUCOTROPHIC ADAPTATION IN ORCHIDACEAE AND PYROLACEAE OFFERS USEFUL INSIGHTS ON THE PHYLOGENETIC PROGRESSION.
KEYWORDS. SYMBIOSIS, PARASITISM, MYCORRHIZA, 'GALEOLA' (ORCHIDACEAE), 'LEIPHAIMOS' (GENTIANACEAE), 'MONOTROPA' (PYROLACEAE).

KNUTSON, DONALD M. 03 71043
DWARF MISTLETOE SEED STORAGE BEST AT LOW TEMPERATURE AND HIGH RELATIVE HUMIDITY.
USDA FOREST SERV. RES. NOTE PNW-145, 8 P., ILLUS.
DWARF MISTELTOE SEEDS ARE SHORT-LIVED, HOWEVER, RELATIVELY HIGH GERMINATION (58 PERCENT CAN BE MAINTAINED FOR 15 MONTHS BY STORAGE AT 1 DEGREE CENTIGRADE AND 75-PERCENT RELATIVE HUMIDITY. INOCULATION STUDIES CAN NOW BE DONE THROUGHOUT THE YEAR.
KEYWORDS. DWARF MISTLETOE, 'ARCEUTHOBIUM CAMPYLOPODUM, SEED STORAGE, SEED GERMINATION.

KNUTSON, DONALD. 04 71036
YEAR-AROUND INOCULATION WITH DWARFMISTLETOE SEEDS. (ABSTR.)
IN 'ABSTRACTS OF THE 1971 JOINT MEETINGS OF IDAHO ACADEMY OF SCIENCE-NORTHWEST SCIENTIFIC ASSOCIATION-WASHINGTON STATE ENTOMOLOGICAL SOCIETY.' (NO COPIES AVAILABLE)
KEYWORDS. DWARFMISTLETOE, INOCULATION, PONDEROSA PINE.

NELSON, EARL E. 02 71042
INVASION OF FRESHLY CUT DOUGLAS-FIR STUMPS BY 'PORIA WEIRII.'
USDA FOREST SERV. RES. NOTE PNW-144, 5 P.
'PORIA WEIRII' SPORE INOCULUM FAILED TO PENETRATE DOUGLAS-FIR STUMPS, BUT VEGETATIVE INOCULUM OF THE FUNGUS READILY COLONIZED UP TO 75 PERCENT OF STUMPS, EXCEEDING 12 INCHES IN 1 YEAR IN SAPWOOD BUT SLOWER IN HEARTWOOD.
KEYWORDS. STUMPS, DOUGLAS-FIR, 'PORIA WEIRII,' ROOT DISEASE.

SHEA, KEITH R., AND DAVID K. LEWIS*. 06 71060
OCCURRENCE OF DWARF MISTLETOE IN SANITIZED PONDEROSA PINE IN SOUTH-CENTRAL OREGON.
NORTHWEST SCI. 45(2), P. 94-99, ILLUS.
DWARF MISTLETOE INFECTIONS CONTINUED TO DEVELOP IN THINNED PONDEROSA PINE SANITIZED YEARLY FOR 10 YEARS. MOST LATENT INFECTIONS PRODUCED AERIAL SHOOTS THE FIRST 5 YEARS, THE MAJORITY WITHIN 3. INCIDENCE APPEARS RELATED DIRECTLY TO INITIAL STAND INFECTION LEVELS. PRUNING IS GENERALLY INEFFECTIVE AS A CONTROL MEASURE DUE TO LATENT INFECTIONS.
KEYWORDS. THINNING (TREES), PONDEROSA PINE, 'PINUS PONDEROSA,' DWARF MISTLETOE, 'ARCEUTHOBIUM CAMPYLOPODUM' F. 'CAMPYLOPODUM,' STAND IMPROVEMENT.

*STEWART, JAMES L., AND KEITH R. SHEA 09 71104
FOREST DISEASES OF THE NORTHWEST.
PACIFIC NORTHWEST FOREST AND RANGE EXP. STA., N.P., ILLUS. (NO COPIES AVAILABLE)
FOREST DISEASES ARE EVALUATED AS A LIMITING FACTOR IN PROVISION OF WOOD, WATER, FORAGE, WILDLIFE, AND RECREATION FOR A GROWING POPULATION.
KEYWORDS. TREE DISEASES, DWARF MISTLETOE, HEART ROT, ROOT ROT, PACIFIC NORTHWEST.

TRAPPE, J. M. 10 71121
A SYNOPSIS OF THE CARBOMYCETACEAE AND TERFEZIACEAE (TUBERALES).
TRANS. BR. MYCOL. SOC. 57(1), P. 85-92.
THESE FAMILIES OF FUNGI IN THE TRUFFLE ORDER ARE WORLDWIDE IN DISTRIBUTION. THEY ARE IMPORTANT BOTH AS MYCORRHIZAL FUNGI AND, IN SOME AREAS, AS FOOD. KEYS AND DESCRIPTIONS OF THE GENERA ARE PROVIDED.
KEYWORDS. NOMENCLATURE, CARBOMYCETACEAE, 'CARBOMYCES,' TERFEZIACEAE, TUBERALES.

TRAPPE, J. M. 09 71125
THE ASCUS IN TAXONOMY AND PHYLOGENY OF THE TUBERALES. (ABSTR.)
FIRST INT. MYCOL. CONGR. ABSTR., 1971, P. 93. (NO COPIES AVAILABLE)
KEYWORDS. TUBERALES, TAXONOMY.

TRAPPE, J. M. 09 71124
THE ECOLOGICAL BASIS FOR TRUFFLE CULTIVATION AND POTENTIAL FOR EXPANDED PRODUCTION. (ABSTR.)
FIRST INT. MYCOL. CONGR. ABSTR., 1971, P. 94. (NO COPIES AVAILABLE)
KEYWORDS. TRUFFLES, TUBERALES.

TRAPPE, JAMES M. 9 71166
MYCORRHIZA-FORMING ASCOMYCETES.
FIRST N. AMER. CONF. ON MYCORRHIZAE PROC. 1971, P. 19-37, ILLUS.
TRUFFLES AND ALLIED FUNGI HAVE FIGURED PROMINENTLY IN MYCORRHIZAL RESEARCH. RELATIVELY LITTLE IS KNOWN ABOUT THEM BECAUSE THEY FRUIT UNDERGROUND AND ARE DIFFICULT TO FIND. NONETHELESS, THEY APPEAR TO BE WIDELY DISTRIBUTED--OVER 40 SPECIES HAVE BEEN REPORTED TO FORM MYCORRHIZAE WITH TREES IN THE NORTHERN TEMPERATE ZONE.
KEYWORDS. MYCORRHIZA, PARASITISM, TAXONOMY.

TRAPPE, JAMES M., AND GASTON GUZMAN*. 7 71189
A NEWLY DETERMINED SPECIES OF ELAPHOMYCES FROM OREGON.
MADRONO 21, P. 128-130, ILLUS.
A FUNGUS KNOWN ONLY FROM A SINGLE COLLECTION FROM AN OREGON FOREST SOIL WAS ORIGINALLY DESCRIBED AS A BASIDIOMYCETE. RECENT STUDIES OF THE SPECIMEN PROVED IT TO BE AN ASCOMYCETE, THE CORRECTED NAME BEING 'ELAPHOMYCES SUBVISCIDUS.'
KEYWORDS. MYCOLOGY, PLANT TAXONOMY, 'ELAPHOMYCES SUBVISCIDUS' COMB. NOV.

TRAPPE, JAMES M., AND GASTON GUZMAN*. 04 71050
NOTES ON SOME HYPOGEOUS FUNGI FROM MEXICO.
MYCOLOGIA LXIII, P. 317-332, ILLUS.
AMONG 18 SPECIES OF SUBTERRANEAN-FRUITING, FLESHY FUNGI, FROM MEXICAN FORESTS BUT MOSTLY KNOWN TO OCCUR IN THE PACIFIC NORTHWEST, THREE ARE DESCRIBED AS NEW SPECIES.
KEYWORDS. FUNGI, MEXICO (FUNGI).

ZAK, B. 07 71086
CHARACTERIZATION AND CLASSIFICATION OF MYCORRHIZAE OF DOUGLAS FIR. II. 'PSEUDOTSUGA MENZIESII' + 'RHIZOPOGON VINICOLOR.'

CAN. J. BOT. 49(7) P. 1079-1084, ILLUS.
THE COMMON TUBERCULATE ECTOMYCORRHIZA OF DOUGLAS-FIR IN THE PACIFIC NORTHWEST IS FURTHER EXAMINED AND DEFINED. ROOT PATHOGENS 'PHYTOPHTHORA CINNAMONI,' 'PYTHIUM DEBARYANUM,' AND 'PYTHIUM SYLVATICUM' WERE STRONGLY INHIBITED BY THE FUNGAL SYMBIONT, IDENTIFIED AS 'RHIZOPOGON VINICOLOR,' IN LABORATORY TESTS.
KEYWORDS. MYCORRHIZA, DOUGLAS-FIR, FUNGUS, SYMBIOSIS.

ZAK, B. 9 71167
CHARACTERIZATION AND IDENTIFICATION OF DOUGLAS-FIR MYCORRHIZAE.
FIRST N. AMER. CONF. ON MYCORRHIZAE PROC. 1971, P. 38-53, ILLUS.
A PROPOSAL FOR CHARACTERIZING AND IDENTIFYING ECTOMYCORRHIZAE OF DOUGLAS-FIR AND OTHER PACIFIC NORTHWEST CONIFERS IS PRESENTED. METHODS TO IDENTIFY THE FUNGAL SYMBIONT ARE DISCUSSED. AND SIMPLE-TO-DETERMINE BUT YET RELATIVELY STABLE CHARACTERS OF ECTOTROPHIC MYCORRHIZAE ARE EXAMINED FOR POSSIBLE USE IN AN IDENTIFICATION KEY.
KEYWORDS. MYCORRHIZA, CLASSIFICATION, MORPHOLOGY.

ZAK, B. 08 71092
DETOXICATION OF AUTOCLAVED SOIL BY A MYCORRHIZAL FUNGUS.
USDA FOREST SERV. RES. NOTE PNW-159, 4 P., ILLUS.
THE MYCORRHIZAL FUNGUS, 'CORTICIUM BICOLOR,' WAS SHOWN TO DEACTIVATE TOXIN(S) FORMED IN SOIL DURING AUTOCLAVING, ALLOWING DOUGLAS-FIR SEEDLINGS TO GROW NORMALLY.
KEYWORDS. SOIL SCIENCE, ROOTS, SEEDLINGS, SOIL FUNGI, 'CORTICIUM BICOLOR,' DOUGLAS-FIR, 'PSEUDOTSUGA MENZIESII.'

PHYSIOLOGY

COCHRAN, P. H. 04 71033
HIGH SOIL WATER CONTENT TOLERANCE OF LODGEPOLE AND PONDEROSA PINE SEEDLINGS. (ABSTR.)
IN 'ABSTRACTS OF THE 1971 JOINT MEETINGS OF IDAHO ACADEMY OF SCIENCE-NORTHWEST SCIENTIFIC ASSOCIATION-WASHINGTON STATE ENTOMOLOGICAL SOCIETY.' (NO COPIES AVAILABLE)
KEYWORDS. SOIL MOISTURE, TOLERANCE, LODGEPOLE PINE, 'PINUS CONTORTA,' PONDEROSA PINE, 'P. PONDEROSA.'

GRATKOWSKI, H. 03 71029
HIGH SOIL TEMPERATURES INDUCE GERMINATION OF SCOTCH BROOM SEEDS.
IN 'RESEARCH PROGRESS REPORT,' WEST. SOC. WEED SCI. 1971, P. 31. (NO COPIES AVAILABLE)
KEYWORDS. SOIL TEMPERATURE, SCOTCH BROOM, 'CYTISUS SCOPARIUS.'

GREEN, K. ALAN, J. C. ZASADA, AND K. VAN CLEVE. 06 71069
AN ALBINO ASPEN SUCKER.
FOREST SCI. 17, P. 172, ILLUS.
POSSIBLY THE FIRST RECORDED OBSERVATION OF AN ALBINO ASPEN ROOT SUCKER WAS MADE EAST OF FAIRBANKS, ALASKA. THESE SUCKERS DIED ABOUT ONE MONTH AFTER INITIAL OBSERVATION.
KEYWORDS. 'POPULUS TREMULOIDES,' MUTATION.

GREGORY, ROBERT A. 02 71011
CAMBIAL ACTIVITY IN ALASKAN WHITE SPRUCE.
AMER. J. BOT. 58, P. 160-171, ILLUS.
MITOTIC INDEX IN THE CAMBIAL ZONE OF ALASKAN WHITE SPRUCE DID NOT VARY WITH GROWTH RATE OF THE SECONDARY VASCULAR TISSUES. GROWTH RATE WAS DEPENDENT PRIMARILY ON SIZE OF THE CAMBIAL ZONE CELL POPULATION.
KEYWORDS. CAMBIUM DEVELOPMENT, ALASKAN WHITE SPRUCE, 'PICEA GLAUCA.'

HURD, RICHARD M. 08 71169
ANNUAL TREE-LITTER PRODUCTION BY SUCCESSIONAL FOREST STANDS, JUNEAU, ALASKA.
ECOLOGY 52, P. 881-884.
LITTER PRODUCTION IN FOUR STANDS (PIONEER 'ALNUS-SALIX' TO OLD-GROWTH 'TSUGA HETEROPHYLLA/PICEA SITCHENSIS') FOR 3 YEARS AVERAGED 2,850 KG/HA. ALTHOUGH PRODUCTION VARIED AMONG STANDS AND YEARS, NO REAL DIFFERENCES WERE APPARENT. NONWOODY LITTER WAS ABOUT 64 PERCENT OF TOTAL LITTER AND, ALTHOUGH LESS VARIABLE, THERE WERE NO CONSISTENT DIFFERENCES FOR STANDS NOR YEARS.
KEYWORDS. FOREST LITTER, SOUTHEAST ALASKA.

LOPUSHINSKY, W. 2 71016
AN IMPROVED WELDING JIG FOR PELTIER THERMOCOUPLE PSYCHROMETERS.
SOIL SCI. SOC. AMER. PROC. 35, P. 149-150, ILLUS.
AN IMPROVED WELDING PROCEDURE IS DESCRIBED FOR MAKING THERMOCOUPLES REQUIRED IN PELTIER PSYCHROMETERS USED FOR MEASUREMENT OF PLANT AND SOIL WATER POTENTIAL. LABORATORY CONSTRUCTED THERMOCOUPLES HAD GREATER RANGE AND SENSITIVE THAN COMMERCIALLY AVAILABLE THERMOCOUPLES.
KEYWORDS. MATRIC AND OSMOTIC POTENTIAL, SOIL WATER STRESS, PLANT WATER STRESS, WATER POTENTIAL.

LOPUSHINSKY, WILLIAM. 04 71037
STOMATAL OPENING IN CONIFER SEEDLINGS IN LIGHT AND DARKNESS AND EFFECT ON TRANSPIRATION RATE. (ABSTR.)
IN 'ABSTRACTS OF THE 1971 JOINT MEETINGS OF IDAHO ACADEMY OF SCIENCE-NORTHWEST SCIENTIFIC ASSOCIATION-WASHINGTON STATE ENTOMOLOGICAL SOCIETY.' (NO COPIES AVAILABLE)
KEYWORDS. STOMATA, TRANSPIRATION, SEEDLINGS.

MASON, RICHARD R. 06 71068
SOIL MOISTURE AND STAND DENSITY AFFECT OLEORESIN EXUDATION FLOW IN A LOBLOLLY PINE PLANTATION.
FOREST SCI. 17, P. 170-177, ILLUS.
FLUCTUATIONS IN MEAN OLEORESIN EXUDATION FLOW WERE POSITIVELY CORRELATED WITH CHANGES IN SOIL MOISTURE AVAILABILITY. HOWEVER, SIMULATED SOIL DROUGHT FOR 4 MONTHS DID NOT SIGNIFICANTLY REDUCE THE MEAN COEF. MEAN FLOW RATES SEEMED TO BE AFFECTED MORE BY STAND DENSITY THAN BY TEMPORARY MOISTURE STRESS.
KEYWORDS. 'PINUS TAEDA,' TREE RESISTANCE, 'IPS' SPP., BARK BEETLES, STAND DENSITY.

MINORE, DON. 04 71038
EFFECTS OF FLOODING AND SHALLOW WATER TABLES ON SURVIVAL AND GROWTH OF SIX NORTHWESTERN TREE SPECIES. (ABSTR.)
IN 'ABSTRACTS OF THE 1971 JOINT MEETINGS OF IDAHO ACADEMY OF SCIENCE-NORTHWEST SCIENTIFIC ASSOCIATION-WASHINGTON STATE ENTOMOLGICAL SOCIETY.' (NO COPIES AVAILABLE)
KEYWORDS. PLANT-WATER RELATIONS, WATER CONSUMPTIVE USE, DOUGLAS-FIR, SITKA SPRUCE, WESTERN HEMLOCK, WESTERN REDCEDAR, LODGEPOLE PINE, RED ALDER.

VAN CLEVE, KEITH, LESLIE A. VIERECK, AND ROBERT L. SCHLENTNER. 06 71066
ACCUMULATION OF NITROGEN IN ALDER ('ALNUS') ECOSYSTEMS NEAR FAIRBANKS, ALASKA.
ARCTIC AND ALPINE RES. 3(2) P. 101-114, ILLUS.
DISTRIBUTION AND RATES OF ACCUMULATION OF BIOMASS AND NITROGEN ARE REPORTED FOR 5- AND 20-YEAR-OLD ALDER ECOSYSTEMS DEVELOPING ON THE TANANA RIVER FLOOD PLAIN IN CENTRAL ALASKA. DISTRIBUTION OF BIOMASS NITROGEN IS SHOWN FOR FOLIAGE, BRANCHES, BOLES, ROOTS AND LITTER, AND SOIL BY PERCENT AND ON A KILOGRAM PER HECTARE BASIS.
KEYWORDS. NITROGEN, ECOSYSTEM, NITROGEN FIXATION, ALDER, 'ALNUS.'

PLANT ECOLOGY

FRANKLIN, JERRY F., AND C. T. DYRNESS. 1 71010
A CHECKLIST OF VASCULAR PLANTS ON THE H. J. ANDREWS EXPERIMENTAL FOREST, WESTERN OREGON.
USDA FOREST SERV. RES. NOTE PNW-138, 37 P., ILLUS.
LISTS 480 PLANT TAXA WHICH HAVE BEEN ENCOUNTERED IN THE 6,000-HECTARE LOOKOUT CREEK DRAINAGE OF WEST-CENTRAL OREGON. NOTES ON HABITATS AND ABUNDANCE ARE INCLUDED FOR MOST TAXA.
KEYWORDS. VASCULAR PLANTS, TRACHEOPHYTES, PLANT ECOLOGY, H. J. ANDREWS EXPERIMENTAL FOREST, OREGON.

FRANKLIN, JERRY F., WILLIAM H. MOIR*, GEORGE W. DOUGLAS*, AND CURT WIBERG*. 08 71093
INVASION OF SUBALPINE MEADOWS BY TREES IN THE CASCADE RANGE, WASHINGTON AND OREGON.
ARCTIC AND ALPINE RES. 3(3), P. 215-224, ILLUS.
FIRE, GRAZING, AND FOREST EDGE EFFECT ARE CONSIDERED TO BE POSSIBLE FACTORS IN THE MOST INTENSE PERIOD OF INVASION DURING 1920 TO 1937, BUT CLIMATIC CHANGE IS MOST PROBABLE CAUSATIVE FACTOR. LITTLE INVASION HAS BEEN NOTED SINCE 1945.
KEYWORDS. MOUNTAIN MEADOWS, TREE CONTROL, ALPINE ECOLOGY.

*FUJIMORI, TAKAO. 12 71186
PRIMARY PRODUCTIVITY OF A YOUNG 'TSUGA HETEROPHYLLA' STAND AND SOME SPECULATIONS ABOUT BIOMASS OF FOREST COMMUNITIES ON THE OREGON COAST.
USDA FOREST SERV. RES. PAP. PNW-123, 11 P., ILLUS.
A 26-YEAR-OLD 'TSUGA HETEROPHYLLA' STAND ON THE OREGON COAST HAD A TOTAL BIOMASS AND CURRENT NET ANNUAL PRODUCTION OF 231.1 AND 36.2 METRIC TONS PER HECTARE, RESPECTIVELY.
KEYWORDS. STAND INCREMENT ESTIMATE, FOREST APPRAISAL, ECOSYSTEM, 'TSUGA HETEROPHYLLA.'

PACIFIC NORTHWEST FOREST AND RANGE EXP. STA. 12 71149
TAIGA-TUNDRA RESEARCH.
2 P., ILLUS.
THE FOLDER GIVES GENERAL INFORMATION ON PERSONNEL, NATURE OF THE STUDIES, PUBLICATIONS, AND ILLUSTRATIONS OF THE RESEARCH PROJECT.
KEYWORDS. INTERIOR ALASKA, RESOURCE PLANNING, RESEARCH, TAIGA, TUNDRA.

RANGE ECOSYSTEMS

ANDERSON, BILL, BILL BILLINGS, HENRY FROEHLICH*, 01 71020
GEORGE GARRISON, ET AL.
OREGON INTERAGENCY GUIDE FOR CONSERVATION AND FORAGE SEEDINGS, 1971.
49 P., ILLUS. (COOPERATIVELY PREPARED BY AGENCIES IN THE U.S. DEPARTMENT OF AGRICULTURE, U.S. DEPARTMENT OF INTERIOR, OREGON STATE UNIVERSITY, OREGON STATE DEPARTMENT OF FORESTRY, AND OREGON STATE GAME COMMISSION.) (NO COPIES AVAILABLE)
PRIMARILY A SUMMARY OF RECOMMENDATIONS ABOUT SEED MIXTURES PLUS PERTINENT NOTES ON CHARACTERISTICS AND ADAPTABILITY OF RANGE GRASSES, LEGUMES, AND SOME BROWSE SPECIES.
KEYWORDS. CONSERVATION (SOIL), FORAGE MANAGEMENT, GRASSES, LEGUMES, RANGE MANAGEMENT, SEED PLANTING, OREGON.

DEALY, J. EDWARD. 12 71196
HABITAT CHARACTERISTICS OF THE SILVER LAKE MULE DEER RANGE.
USDA FOREST SERV. RES. PAP. PNW-125, 99 P., ILLUS.
TWENTY-ONE ECOSYSTEMS OF THE SILVER LAKE MULE DEER RANGE IN NORTHERN LAKE COUNTY, OREGON, ARE DESCRIBED. DISCUSSIONS ARE INCLUDED ON ECOSYSTEM INTERRELATIONSHIPS AND VALUE AND MANAGEMENT FOR GAME. A FIELD KEY TO ECOSYSTEMS HAS BEEN DEVELOPED.
KEYWORDS. ECOSYSTEM, HABITAT, MULE DEER, VEGETATION, SOILS, SITE CLASS.

EDGERTON, PAUL J. 12 71195
THE EFFECT OF CATTLE AND BIG GAME GRAZING ON A PONDEROSA PINE PLANTATION.
USDA FOREST SERV. RES. NOTE PNW-172, 8 P., ILLUS.
AFTER FIVE GROWING SEASONS, GRAZING BY DEER AND ELK OR DEER, ELK, AND CATTLE HAD NEITHER GREATLY HARMED NOR BENEFITED GROWTH AND SURVIVAL OF PLANTED TREES IN A MIXED-CONIFER CLEARCUT SEEDED TO GRASS.
KEYWORDS. GRAZING LAND, RANGE MANAGEMENT, FOREST CLEARCUTTING, PONDEROSA PINE.

EDGERTON, PAUL J., AND JUSTIN G. SMITH 06 71065
SEASONAL FORAGE USE BY DEER AND ELK ON THE STARKEY EXPERIMENTAL FOREST AND RANGE, OREGON.
USDA FOREST SERV. RES. PAP. PNW-112, 12 P., ILLUS.
DIET AND OCCUPANCY ON OPEN AND DENSE FOREST AND GRASSLAND HABITATS WERE GREATLY INFLUENCED BY THE SEASONAL AVAILABILITY OF PREFERRED FORAGE PLANTS. HABITAT RATINGS SHOWED THAT OPEN FOREST WAS THE MOST IMPORTANT AT ALL SEASONS, ELK SEDGE WAS THE STAPLE FORAGE PLANT.
KEYWORDS. FORAGE PLANTS, HABITATS, FOOD HABITS, MULE DEER ('ODOCOILEUS HEMIONUS HEMIONUS'), ROCKY MOUNTAIN ELK ('CERVUS CANADENSIS NELSONI'), ELK SEDGE ('CAREX GEYERII'), STARKEY EXPERIMENTAL FOREST AND RANGE, OREG.

MCCONNELL, BURT R., AND JUSTIN G. SMITH. 07 71090
EFFECT OF PONDEROSA PINE NEEDLE LITTER ON GRASS SEEDLING SURVIVAL.
USDA FOREST SERV. RES. NOTE PNW-155, 6 P., ILLUS.
HARD FESCUE SURVIVAL RATES WERE FOLLOWED FOR 6 YEARS ON FOUR DIFFERENT PINE NEEDLE TREATMENT PLOTS. NEEDLE LITTER HAD A SIGNIFICANT EFFECT ON INITIAL SURVIVAL OF FESCUE SEEDLINGS, BUT SUBSEQUENT LOSSES UNDOUBTEDLY RESULTED FROM THE INTERACTION OF MANY FACTORS.
KEYWORDS. PINE NEEDLES, LITTER, GRASS SEEDLINGS, PONDEROSA PINE, 'PINUS PONDEROSA.'

MCCONNELL, BURT R., AND SMITH, JUSTIN G. 04 71059
INFLUENCE OF GRAZING AND AGE ON CROWN CHARACTERISTICS IN BITTERBRUSH.
USDA FOREST SERV. RES. NOTE PNW-146, 4 P., ILLUS.
CHANGES IN AVERAGE CROWN DIAMETER AND PERCENTAGE OF DEAD CROWN WERE RELATED TO BITTERBRUSH ('PURSHIA TRIDENTATA') AGE ON MODERATELY AND HEAVILY GRAZED RANGES. THERE WAS A SIGNIFICANT DIFFERENCE IN AVERAGE CROWN DIAMETER UNDER THE TWO LEVELS OF GRAZING INTENSITY, BUT THE DIFFERENCE BETWEEN PERCENTAGES OF DEAD CROWN AREA WAS NOT SIGNIFICANT.
KEYWORDS. BITTERBRUSH, PLANT AGE, GRAZING, CROWN CHARACTERISTICS.

SKOVLIN, JON M. 07 71080
RANCHING IN EAST AFRICA--A CASE STUDY.
J. RANGE MANAGE. 24, P. 263-270, ILLUS.
PROGRESSIVE RANCHING IS CONTRASTED WITH TRADITIONAL PASTORALISM IN AN EFFORT TO SHOW HOW LAGGING RANGELANDS MIGHT CONTRIBUTE MORE TO ECONOMIES OF EMERGING COUNTRIES. GRASSLAND POTENTIAL AND PROBLEMS OF RANGELAND DEVELOPMENT IN EAST AFRICA ARE ALSO CONSIDERED.
KEYWORDS. RANGE MANAGEMENT, LIVESTOCK, AFRICA (EAST).

TIEDEMANN, A. R., AND H. W. BERNDT. 04 71041
VEGETATION AND SOILS OF A 30-YEAR DEER AND ELK EXCLOSURE IN CENTRAL WASHINGTON. (ABSTR.)
IN 'ABSTRACTS OF THE 1971 JOINT MEETINGS OF IDAHO ACADEMY OF SCIENCE-NORTHWEST SCIENTIFIC ASSOCIATION-WASHINGTON STATE ENTOMOLOGICAL SOCIETY.' (NO COPIES AVAILABLE)
KEYWORDS. SNOWBRUSH CEANOTHUS, SOILS, VEGETATION, SOIL ANALYSIS, WILDLIFE FOOD PLANTS.

TIEDEMANN, ARTHUR R., AND JAMES O. KLEMMEDSON*. 2 71012
EFFECT OF MESQUITE 'PROSOPIS JULIFLORA' TREES ON VEGETATION AND SOILS IN THE DESERT GRASSLAND. (ABSTR.)
IN 'JOURNAL OF RANGE MANAGEMENT ABSTRACTS OF PAPERS,' SOC. RANGE MANAGE. 24TH ANNU. MEETING, RENO, P. 15-16.
TREATMENT RESPONSES SUGGEST INCREASED GRASS COVER FOUND UNDER MESQUITE RESULTS FROM IMPROVED NUTRIENT CONDITIONS UNDER THE TREES AND SHADE TOLERANCE OF SPECIES FOUND THERE RATHER THAN GREATER AVAILABILITY OF SOIL MOISTURE.
KEYWORDS. GRASSLAND MANAGEMENT, MESQUITE, 'PROSOPIS.'

TIEDEMANN, ARTHUR R., JAMES O. KLEMMEDSON*, AND PHIL R. OGDEN*. 11 71136
RESPONSE OF FOUR PERENNIAL SOUTHWESTERN GRASSES TO SHADE.
J. RANGE MANAGE. 24, P. 442-447, ILLUS.
EVALUATION OF MORPHOLOGICAL, PHYSIOLOGICAL, AND YIELD RESPONSES SHOWED THAT ALL PLANTS MADE THEIR BEST GROWTH IN FULL SUNLIGHT, BUT ARIZONA COTTONTOP, BUSH MUHLY, AND PLAINS BRISTLEGRASS DISPLAYED GREATER ABILITY THAN BLACK GRAMA TO ADAPT TO SHADE.
KEYWORDS. GRASSES, GRASSLAND FARMING, MESQUITE.

RECREATION

BURGESS, ROBERT L., ROGER N. CLARK, AND JOHN C. HENDEE. 09 71112
AN EXPERIMENTAL ANALYSIS OF ANTI-LITTER PROCEDURES.
J. APPLIED BEHAVIOR ANALYSIS 4, P. 71-75, ILLUS.
THE DIFFERENTIAL EFFECTIVENESS OF SIX DIFFERENT ANTI-LITTER PROCEDURES IN TWO NEIGHBORHOOD THEATERS IS EVALUATED.
KEYWORDS. LITTER (PUBLIC PLACES), PSYCHOLOGY, SOCIOLOGY.

*BUTTERWORTH, STEPHEN ERNEST. 12 70203
DEVELOPMENT OF MODEL GUIDEBOOKS FOR GLACIER PEAK WILDERNESS.
UNIV. WASH.--A THESIS SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF SCIENCE, 1970, 70 P. (NO COPIES AVAILABLE)
INTERVIEWS OF VISITORS TO GLACIER PEAK WILDERNESS REVEALED USER PREFERENCES FOR SUBJECT MATTER, RELATIVE SPACE, AND FORMAT FOR A WILDERNESS INTERPRETIVE GUIDEBOOK. OBJECTIVES OF GUIDEBOOK ARE DISCUSSED. PREFERENCES FOR GUIDEBOOK CONTENT WERE MAP, GEOLOGY, ANIMALS, CLIMATIC FORCES, PLANTS AND HUMAN HISTORY. NEARLY 80 PERCENT WOULD PAY $1 AND 40 PERCENT $2 FOR GOOD GUIDEBOOK.
KEYWORDS. FOREST RECREATIONAL USE, NATIONAL FORESTS, GLACIER PEAK WILDERNESS.

CAMPBELL, FREDERICK L. 12 70193
PARTICIPANT OBSERVATION IN OUTDOOR RECREATION.
J. LEISURE RES. 2, P. 226-236
THE ADVANTAGES AND LIMITATIONS OF PARTICIPANT OBSERVATION AS A RECREATION RESEARCH METHOD ARE DISCUSSED, BASED ON EXPERIENCE GAINED IN A PARTICIPANT OBSERVATION STUDY OF DEPRECIATIVE CAMPGROUND BEHAVIOR AND LITERATURE REVIEW.
KEYWORDS. RECREATION RESEARCH, PARTICIPANT OBSERVATION, RECREATIONISTS, SOCIAL RESEARCH.

*CLARK, ROGER. 12 70206
RECREATION RESEARCH IN GEOGRAPHY--A CRITICAL ANALYSIS.
IN 'HAROLD D. FOSTER AND W. R. DERRICK SEWELL, EDS., RESOURCES, RECREATION AND RESEARCH.' WEST. GEOGR. SER., VOL. 3, OCCAS. PAP. GEOGR. 13, P. 162-166. (NO COPIES AVAILABLE)
THE AUTHOR EVALUATES SOCIAL SCIENCE RESEARCH IN OUTDOOR RECREATION, PARTICULARLY BY GEOGRAPHERS.
KEYWORDS. RECREATION, GEOGRAPHY, RESEARCH, SOCIAL SCIENCES.

*CLARK, ROGER N. 12 71163
UNDESIRABLE BEHAVIOR IN FOREST CAMPGROUNDS.
FOREST RECREATION SYMP. PROC. 1971, P. 150-155, ILLUS. (NO COPIES AVAILABLE)
CONTROL MEASURES ARE DISCUSSED, INCLUDING AN INCENTIVE SYSTEM UTILIZING MONETARY AND NONMONETARY REWARDS, WHICH WAS USED SUCCESSFULLY TO CONTROL LITTERING IN A LARGE FOREST CAMPGROUND.
KEYWORDS. CAMPING, FOREST RECREATION USE, VANDALISM, LITTER (PUBLIC PLACES).

CLARK, ROGER N., JOHN C. HENDEE, AND FREDERICK L. CAMPBELL. 08 71110
DEPRECIATIVE BEHAVIOR IN FOREST CAMPGROUNDS--AN EXPLORATORY STUDY.

USDA FOREST SERV. RES. NOTE PNW-161, 12 P.
EMPIRICAL DATA BASED ON STRUCTURED OBSERVATION SCHEDULES INDICATED A NUMBER OF FACTORS ASSOCIATED WITH VANDALISM, THEFT, LITTERING, RULE VIOLATION, AND NUISANCE BEHAVIORS AND POSSIBLE METHODS OF CONTROL.
KEYWORDS. CAMPING, FOREST RECREATIONAL USE, RECREATION.

CLARK, ROGER N., JOHN C. HENDEE, AND FREDERICK L. CAMPBELL. 09 71102
VALUES, BEHAVIOR, AND CONFLICT IN MODERN CAMPING CULTURE.
J. LEISURE RES. 3, P. 143-159.
EXAMINATION OF VALUES AND BEHAVIORS OF CAMPERS AND MANAGERS OF DEVELOPED CAMPGROUNDS REVEAL SIGNIFICANT DIFFERENCES IN THEIR CAMPING EXPECTATIONS. THESE DIFFERENCES MAY HELP EXPLAIN WHY CERTAIN TYPES OF BEHAVIOR PROBLEMS OCCUR IN MODERN CAMPGROUNDS.
KEYWORDS. FOREST RECREATION USE, CAMPING, SOCIOLOGY, LEISURE.

HARRY, JOSEPH, RICHARD P. GALE, AND JOHN C. HENDEE. 04 71071
A COMMENT--'CONSERVATION, AN UPPER-MIDDLE CLASS SOCIAL MOVEMENT,' AND REPLY TO MCEVOY, ORGANIZED CONSERVATIONISTS 'ARE' UPPER-MIDDLE CLASS.
J. LEISURE RES. 3, P. 127-131.
TECHNICAL AND IDEOLOGICAL CRITICISM BY JAMES MCEVOY, III OF THE ARTICLE 'CONSERVATION, AN UPPER-MIDDLE CLASS SOCIAL MOVEMENT' IS RESPONDED TO BY THE AUTHORS IN THE COMMUNICATIONS SECTION OF THE JOURNAL OF LEISURE RESEARCH.
KEYWORDS. CONSERVATIONISTS, NATURAL RESOURCE CONSERVATION.

HENDEE, JOHN C. 01 71002
BOOK REVIEW OF 'THE WILD CASCADES, FORGOTTEN PARKLAND,' AND 'THE LAST REDWOODS AND THE PARKLAND OF REDWOOD CREEK.'
FOREST HISTORY 14(4), P. 35-36. (NO COPIES AVAILABLE)
KEYWORDS. NATIONAL PARKS, NATURAL RESOURCE CONSERVATION, NORTH CASCADES, REDWOODS.

HENDEE, JOHN C. 12 71164
MEMBERSHIP IN CONSERVATION GROUPS AND OUTDOOR CLUBS.
FOREST RECREATION SYMP. PROC. 1971, P. 123-127.
(NO COPIES AVAILABLE)
NUMEROUS CONSERVATION GROUPS AND OUTDOOR CLUBS ARE A MAJOR INFLUENCE ON NATURAL RESOURCE POLICY THROUGH THEIR ARTICULATE MEMBERS. DIFFERENT KINDS OF GROUPS ARE DESCRIBED--THEIR MEMBERSHIP, REPRESENTATIVENESS, POTENTIAL GROWTH, MULTIPLE MEMBERSHIPS, AND COMPARABILITY WITH OTHER VOLUNTARY ORGANIZATIONS.
KEYWORDS. ORGANIZATIONS, FOREST RECREATIONAL USE, NATURAL RESOURCE CONSERVATION.

HENDEE, JOHN C. 3 70190
RECREATIONAL VALUES, USE AND MANAGEMENT OF NATURAL AREAS.
IN 'NATURAL AREAS--NEEDS AND OPPORTUNITIES,' WILLIAM J. DITTRICH AND JAMES M. TRAPPE (EDS.). NORTHWEST SCI. ASS. FORTY-THIRD ANNU. MEETING SYMP. PROC. 1970, P. 35-38.
TOPIC IS SPECIFICALLY DEFINED AS REMOTE NATURAL AREAS OF WILDLANDS, NOT NECESSARILY WILDERNESS BUT RELATIVELY INSULATED FROM CIVILIZED INFLUENCE, THE USE AND USERS CHARACTERIZING SUCH AREAS, AND THEIR NECESSARY ASSOCIATE MANAGEMENT.
KEYWORDS. RECREATION RESEARCH, FOREST RECREATIONAL USE, FOREST MANAGEMENT, WILDERNESS AREAS.

HENDEE, JOHN C. 07 71076
SOCIOLOGY AND APPLIED LEISURE RESEARCH.
PAC. SOCIOL. REVIEW 14(3), P. 360-368.
AN APPEAL FOR RELEVANCE, INVESTMENT OF EFFORT FOR SOCIAL UTILITY OF FINDINGS, INTEGRATING LEISURE BEHAVIOR WITH BROADER SOCIAL CONTEXTS, AND SIMULTANEOUS CONCERN WITH THEORETICAL ISSUES AND APPLICATION, TO ENHANCE THE GROWTH AND USEFULNESS OF LEISURE RESEARCH IN SOCIOLOGY. EXAMPLES ARE OFFERED.
KEYWORDS. RECREATION, SOCIOLOGY.

HENDEE, JOHN C., AND RICHARD L. BURY*. 2 71007
DOES RECREATIONAL DEVELOPMENT PAY OFF.
WESTERN CONSERV. J. XXVIII(1), P. 28-30, ILLUS.
CORPORATE FOREST OWNERS ARE INTERESTED IN THE PROFIT POTENTIAL OF THE PUBLIC RECREATION THEY ALL PROVIDE. DIRECT PROFITS SEEM UNLIKELY IN THE NEAR FUTURE, BUT A CLOSE LOOK AT THE COSTS AND INDIRECT BENEFITS WILL HELP COMPANIES DECIDE HOW MUCH TO PARTICIPATE.
KEYWORDS. FOREST RECREATIONAL USE, RECREATION, FOREST PRODUCTS INDUSTRIES, ECONOMICS (FOREST PRODUCTS INDUSTRIES), PUBLIC RELATIONS.

HENDEE, JOHN C., RICHARD P. GALE*, AND WILLIAM R. CATTON, JR.*. 10 71114
A TYPOLOGY OF OUTDOOR RECREATION ACTIVITY PREFERENCE.
J. ENVIORN. EDUC. 3(1), P. 28-34, ILLUS.
A TYPOLOGY TO CLASSIFY RECREATION ACTIVITIES FOR MORE MEANINGFUL ANALYSIS IS PROPOSED AND RELATED TO AGE, EDUCATION, AND DATA COLLECTION METHODS.
KEYWORDS. FOREST RECREATIONAL USE, MOTIVATION RESEARCH, RECREATION.

HENDEE, JOHN C., AND DALE R. POTTER. 12 71191
HUMAN BEHAVIOR AND WILDLIFE MANAGEMENT--NEEDED RESEARCH.
36TH NORTH AMER. WILDLIFE AND NATUR. RESOUR. CONF., 1971, P. 384-396.
BROAD AREAS TO WHICH RESEARCH SHOULD BE DIRECTED ARE HUNTING SATISFACTION, NON-CONSUMPTIVE USE OF WILDLIFE, THE HUNTER POPULATION, ACCESS AND HUNTING OPPORTUNITY, WILDLIFE ECONOMICS, AND POLITICAL-LEGAL ISSUES.
KEYWORDS. WILDLIFE MANAGEMENT, RESEARCH, HUNTING, RECREATION.

HENDEE, JOHN, AND ROBERT PYLE*. 10 71132
WILDERNESS MANAGERS, WILDERNESS USERS--A PROBLEM OF PERCEPTION.
NATURALIST 22(3), P. 22-26, ILLUS. (NO COPIES AVAILABLE)
THIS ARTICLE EXPLORES SOME REASONS WHY USER ATTITUDES ARE NOT ALWAYS ACCURATELY FORECAST BY FORESTERS.
KEYWORDS. WILDERNESS MANAGEMENT, WILDERNESS AREAS, RECREATION, ATTITUDES.

NIELSON, JOYCE M., AND WILLIAM R. CATTON, JR.. 09 71105
FOREST RECREATION PROPOSITIONAL INVENTORY.
J. LEISURE RES. 3, P. 178-193. (NO COPIES AVAILABLE)
THE PROCEDURE CONSISTS OF RECORDING AND STORING SUBSTANTIVE, METHODOLOGICAL, BIBLIOGRAPHICAL AND CONTEXTUAL INFORMATION FROM PUBLISHED ARTICLES IN THE FORM OF RETRIEVABLE PROPOSITIONS.
KEYWORDS. INFORMATION RETRIEVAL SYSTEMS, LEISURE, FOREST RECREATIONAL USE, SOCIOLOGY.

POTTER, DALE R., AND J. ALAN WAGAR. 12 71145
TECHNIQUES FOR INVENTORYING MANMADE IMPACTS IN ROADWAY ENVIRONMENTS.
USDA FOREST SERV. RES. PAP. PNW-121, 12 P., ILLUS.
FOUR TECHNIQUES FOR INVENTORYING MANMADE IMPACTS ALONG ROADWAY CORRIDORS WERE DEVISED AND COMPARED ON THE BASIS OF TYPE AND QUALITY OF DATA OBTAINED, TYPES OF MAPS PRODUCED, AREA COVERED, AND RELATIVE COST AND TIME REQUIREMENTS.
KEYWORDS. ENVIRONMENT, ROADSIDE IMPROVEMENT, LANDSCAPE MANAGEMENT, PHOTOGRAPHY.

WAGAR, J. ALAN. 12 71165
COMMUNICATING WITH RECREATIONISTS.
FOREST RECREATION SYMP. PROC. 1971, P. 161-165.
(NO COPIES AVAILABLE)
RECREATIONISTS ARE FREE TO IGNORE MANY OF A LAND MANAGER'S COMMUNICATION EFFORTS. GREATEST EFFECTIVENESS CAN BE EXPECTED FOR PRESENTATIONS THAT ARE DYNAMIC AND ARE TAILORED TO THE INTERESTS AND OTHER CHARACTERISTICS OF SELECTED VISITOR GROUPS, THAT PERMIT PARTICIPATION AND REWARD LEARNING, AND THAT PROVIDE BOTH AN IDEA OF WHAT IS COMING AND A FRAMEWORK TO GIVE IT COHERENCE.
KEYWORDS. EDUCATIONAL PSYCHOLOGY, FOREST RECREATIONAL USE, COMMUNICATION.

REGENERATION

COCHRAN, P. H. 12 70196
SEEDING PONDEROSA PINE.
IN 'REGENERATION OF PONDEROSA PINE' OREG. STATE UNIV. SYMP. PROC. 1969, P. 28-35.
A REVIEW OF LITERATURE AND CURRENT PRACTICES IN THE PACIFIC NORTHWEST IS PRESENTED. SEEDING IS 'NOT' A SOLUTION TO ALL PONDEROSA PINE REGENERATION PROBLEMS, AND SUCCESS IS LIKELY ONLY ON MEDIUM AND BETTER SITES WHERE RECOMMENDED PRACTICES ARE STRICTLY FOLLOWED.
KEYWORDS. SEED PLANTING, REFORESTATION, PONDEROSA PINE.

EDGREN, JAMES W. 12 71155
SURVIVAL AND GROWTH OF UNDERCUT DOUGLAS-FIR NURSERY STOCK AFTER OUTPLANTING.
WEST. FOREST NURSERY COUNCIL AND INTERMOUNTAIN FOREST NURSERYMEN'S ASS. PROC., 1971, P. 1-3. (NO COPIES AVAILABLE)
CAUTION IS INDICATED IN THE BROAD APPLICATION OF UNDERCUTTING AS A NURSERY PRACTICE. WHEN PLANTED ON THEIR NATIVE SITES, SOME SOURCES OF DOUGLAS-FIR APPARENTLY BENEFIT WHILE OTHERS DO NOT.
KEYWORDS. NURSERY STOCK (FORESTRY), DOUGLAS-FIR.

FLORA, DONALD F. 12 70201
IS REFORESTATION ECONOMICALLY POSSIBLE.
IN 'WESTERN REFORESTATION,' 61ST WEST. CONF. PROC., 1970, P. 42-44 .
REVIEWS THREE ECONOMIC SITUATIONS AFFECTING REGENERATION DECISIONS. THESE ARE EVEN-FLOW MANAGEMENT, POLICY-BASED LINKAGE OF HARVESTING WITH REGENERATION, AND REFORESTATION BACKLOG SITUATIONS.
KEYWORDS. REFORESTATION ECONOMICS, REGENERATION ECONOMICS.

MINORE, DON. 2 71008
SHADE BENEFITS DOUGLAS-FIR IN SOUTHWESTERN OREGON CUTOVER AREA.
TREE PLANT. NOTES 22(1), P. 22-23, ILLUS.
SHADE WAS ESSENTIAL TO DOUGLAS-FIR SEEDLING SURVIVAL ON A HOT, DRY SITE IN SOUTHWESTERN OREGON. LIVE SHADE PROVIDED BY PLANTING UNDER BRUSH WAS ALMOST AS EFFECTIVE AS DEAD SHADE PROVIDED BY PILING ROCKS OR BARK AROUND THE PLANTED SEEDLING, AND THE LIVE SHADE WAS LESS EXPENSIVE.
KEYWORDS. PROTECTIVE SHADING, SEEDLING SURVIVAL, 'PSEUDOTSUGA MENZIESII,' REFORESTATION, FOREST ECOLOGY.

OWSTON, PEYTON W. 04 71039
CONTAINERIZED DOUGLAS-FIR GROWS WELL IN PEAT MOSS-VERMICULITE MIXTURES. (ABSTR.)
IN 'ABSTRACTS OF THE 1971 JOINT MEETINGS OF IDAHO ACADEMY OF SCIENCE-NORTHWEST SCIENTIFIC ASSOCIATION-WASHINGTON STATE ENTOMOLOGICAL SOCIETY.' (NO COPIES AVAILABLE)
KEYWORDS. POTTING MIXTURE, PEAT, VERMICULITE, DOUGLAS-FIR.

STEIN, WILLIAM I. 12 70202
1970 LISTING OF SELECTED PUBLICATIONS ON REFORESTATION.
IN 'WESTERN REFORESTATION ' 61ST WEST. FOREST. CONF. PROC., 1970, P. 53-64.
A COMPILED LIST OF RECENT PUBLICATIONS ON ANY PHASE OF REFORESTATION IN THE WESTERN UNITED STATES AND CANADA PLUS ADDITIONAL PERTINENT REFERENCES FROM THE WORLDWIDE LITERATURE.
KEYWORDS. REFORESTATION.

TRAPPE, JAMES M. 08 71106
ROOT PRUNING CONIFERS IN NURSERY BEDS--DOES IT INCREASE SURVIVAL POTENTIAL.
TREE PLANTERS' NOTES 22(3), P. 13.
THE FORM OF ROOT SYSTEM AND TOP/ROOT RATIO THAT BEST EQUIP NURSERY STOCK FOR SURVIVAL AFTER OUTPLANTING ARE OPEN TO QUESTION. NO SINGLE NURSERY TECHNIQUE CAN BE GUARANTEED TO PRODUCE A GIVEN FORM OF ROOT SYSTEM ON ALL SPECIES OR VARIETIES OF NURSERY STOCK.
KEYWORDS. ROOTS, SEEDLINGS, PRUNING.

ZASADA, JOHN C. 05 71051
FROST DAMAGE TO WHITE SPRUCE CONES IN INTERIOR ALASKA.
USDA FOREST SERV. RES. NOTE PNW-149, 7 P., ILLUS.
CONE AND SEED PRODUCTION IS EXAMINED FOR SEVERAL WHITE SPRUCE ('PICEA GLAUCA') STANDS IN ALASKA AFTER A LATE MAY FROST KILLED OR DAMAGED DEVELOPING CONELETS. THIS IS THE FIRST TIME FROST DAMAGE TO CONE AND SEED CROPS HAS BEEN OBSERVED IN THIS SUBARCTIC REGION.
KEYWORDS. FROST (FOREST DAMAGE), WHITE SPRUCE, CONE DAMAGE, TREE INJURIES.

ZASADA, JOHN C. 12 71142
NATURAL REGENERATION OF INTERIOR ALASKA FORESTS--SEED, SEEDBED, AND VEGETATIVE REPRODUCTION CONSIDERATIONS.
IN 'FIRE IN THE NORTHERN ENVIRONMENT, A SYMPOSIUM,' C. W. SLAUGHTER, RICHARD J. BARNEY, AND G. M. HANSEN (EDS.). USDA FOREST SERV. PAC. NORTHWEST FOREST + RANGE EXP. STA., PORTLAND, OREGON, P. 231-246.
USING ALASKA-DERIVED DATA, WHERE POSSIBLE, THIS PAPER REVIEWS SEED, SEEDBED, AND VEGETATIVE REPRODUCTION VARIABLES FOR WHITE SPRUCE, BLACK SPRUCE, PAPER BIRCH, QUAKING ASPEN, AND BALSAM POPLAR AS THEY RELATE TO REFORESTATION FOLLOWING FIRE IN INTERIOR ALASKA.
KEYWORDS. FIRE CONTROL, ENVIRONMENT, ALASKA, REFORESTATION.

RESIDUES

ANONYMOUS. 11 71130
FOREST PRODUCTS RESIDUES--THEIR VOLUME, USE AND VALUE.
FOREST IND. 98(12), P. 22-27, ILLUS.
HOWARD, JAMES O. 1. VOLUME OF RESIDUES FROM LOGGING, P. 22-23, ILLUS. ABOUT 1,016.9 MILLION CUBIC FEET OF LOGGING RESIDUES RESULTED FROM TIMBER HARVESTING IN 1969, IN OREGON, WASHINGTON, AND CALIFORNIA.
KEYWORDS. WASTE UTILIZATION, WOOD WASTE, LOGGING, WASTE VOLUME ESTIMATES.
GEDNEY, DONALD R. 2. RESIDUES FROM PRIMARY MANUFACTURING, P. 24-25. TODAY'S PRIMARY FOREST INDUSTRIES ARE USING MORE OF THE RESIDUE GENERATED IN MANUFACTURING. IN THE FUTURE LITTLE SHOULD REMAIN UNUSED.
KEYWORDS. WASTE UTILIZATION, WOOD WASTE.
HAMILTON, THOMAS E. 3. PRICES OF PRIMARY MANUFACTURING RESIDUES, P. 25-26. PRICES FOR PULPWOOD CHIPS HAVE RISEN AT A RATE OF ABOUT $1 PER YEAR THROUGHOUT THE DECADE OF THE 1960'S.
KEYWORDS. PULPWOOD CHIPS, SAWDUST, PRICES.
WALL, BRIAN R. 4. RESIDUES FROM SECONDARY MANUFACTURING, P. 26-27. IN WASHINGTON, OREGON, AND CALIFORNIA, IT WAS ESTIMATED THAT SECONDARY MANUFACTURING PLANTS GENERATED 16.4 MILLION CUBIC FEET OF SOFTWOOD COARSE RESIDUE IN 1970, 77 PERCENT WAS USED OF 1.2 MILLION CUBIC FEET. OF HARDWOOD COARSE RESIDUE, 52 PERCENT WAS USED.
KEYWORDS. WOOD WASTE, WASTE UTILIZATION.

BOLLEN, W. B. 12 71184
SALTY BARK AS A SOIL AMENDMENT.
USDA FOREST SERV. RES. PAP. PNW-128, 16 P.
SALT CONTENT OF DOUGLAS-FIR BARK FROM LOGS FLOATED IN SEA WATER RANGED FROM 0.75 TO 1.94 PERCENT. THIS SALT WAS READILY REMOVED BY LEACHING WITH RAINFALL OR SOAKING. SALTY BARK MULCHES AND INCORPORATIONS DEPRESSED GROWTH OF BEAN AND TOMATO PLANTS IN THE GREENHOUSE. FEW SOIL BACTERIA WERE AFFECTED BY SALT.
KEYWORDS. FOREST PRODUCTS RESEARCH, BARK, SALINE WATER, PLANT GROWTH INHIBITORS.

DELL, JOHN D., AND FRANKLIN R. WARD. 08 71082
LOGGING RESIDUES ON DOUGLAS-FIR REGION CLEARCUTS--WEIGHTS AND VOLUMES.
USDA FOREST SERV. RES. PAP. PNW-115, 10 P., ILLUS.
THIS PAPER PRESENTS THE RESULTS OF GROUND MEASUREMENTS OF LOGGING RESIDUE WEIGHTS AND VOLUMES ON 30 CLEARCUT UNITS IN DOUGLAS-FIR FORESTS OF WESTERN OREGON AND WASHINGTON. ADDITIONAL INFORMATION IS GIVEN ON QUANTITIES OF MATERIAL LEFT AS SLASH WHICH MIGHT BE UTILIZED. THESE MEASUREMENTS WERE MADE ON PUBLIC LANDS, USING A METHOD DEVELOPED IN CANADA.
KEYWORDS. SLASH DISPOSAL, CUTTING (HARVEST), FOREST FUELS, FUELWOOD USE, CLEARING OPERATIONS.

FAHNESTOCK, GEORGE R., AND WILLIAM K. KEY*. 03 71017
WEIGHT OF BRUSHY FOREST FIRE FUELS FROM PHOTOGRAPHS.
FOREST SCI. 17, P. 119-124, ILLUS.
CALIBRATED DOT COUNTS FROM A GRID SUPERIMPOSED ON HORIZONTAL COLOR PHOTOGRAPHS OF SMALL PLOTS YIELD WEIGHT ESTIMATES COMPARABLE WITH THOSE FROM PHYSICAL SAMPLES. THE TECHNIQUE COSTS MUCH LESS AND IS MUCH MORE VERSATILE THAN PHYSICAL SAMPLING.
KEYWORDS. MYRICA CERIFERA, SAMPLING METHODS.

HALL, J. ALFRED. 11 71182
BARK--OLD AND NEW.
CONVERTING BARK INTO OPPORTUNITIES CONF. PROC., 1971, P. 3-7.
BARK WAS IMPORTANT UP TO ABOUT WORLD WAR II FOR MANY USES. NOW, DISPOSAL OR DEVELOPMENT OF NEW USES HAS BECOME A MAJOR PROBLEM. THE PROBLEM CAN BE SOLVED BY MAJOR ATTACK.
KEYWORDS. BARK UTILIZATION, FOREST PRODUCTS, WOOD TECHNOLOGY.

HALL, J. ALFRED. 2 71004
UTILIZATION OF DOUGLAS-FIR BARK.
PAC. NORTHWEST FOREST AND RANGE EXP. STA., 138 P., ILLUS.
WITH ENVIRONMENTAL QUALITY CONTROL LIMITING BURNING--GENERALLY THE CHEAPEST AND MOST FEASIBLE BARK DISPOSAL METHOD--INTEREST IN DEVELOPING ECONOMIC USES HAS GROWN. THIS IS A COMPREHENSIVE TECHNICAL REVIEW OF DOUGLAS-FIR BARK USES.
KEYWORDS. BARK UTILIZATION, 'PSEUDOTSUGA MENZIESII,' WOOD WASTE, QUERCETIN, PHENOLS, TANNINS, WOOD CHEMISTRY.

HOWARD, JAMES O. 08 71111
VOLUME OF LOGGING RESIDUES IN OREGON, WASHINGTON, AND CALIFORNIA--INITIAL RESULTS FROM A 1969-70 STUDY.
USDA FOREST SERV. RES. NOTE PNW-163, 6 P.
A LOGGING RESIDUE STUDY CONDUCTED DURING 1969-70 IN OREGON, WASHINGTON, AND CALIFORNIA SHOWED AVERAGE NET VOLUME RANGED FROM 325 TO 3,156 CUBIC FEET PER ACRE. THE TOTAL THREE-STATE VOLUME WAS ABOUT 908 MILLION CUBIC FEET, OR ABOUT 26 PERCENT OF THE REPORTED 1969 LOG HARVEST.
KEYWORDS. LOGGING SLASH, WOOD WASTE, WASTE UTILIZATION.

SOILS, SITE, AND GEOLOGY

ANDERSON, T. D., AND A. R. TIEDEMANN 04 71031
RAPID ANALYSIS OF TOTAL SULPHUR IN SOILS AND PLANT MATERIAL. (ABSTR.)
IN 'ABSTRACTS OF THE 1971 JOINT MEETINGS OF IDAHO ACADEMY OF SCIENCE-NORTHWEST SCIENTIFIC ASSOCIATION-WASHINGTON STATE ENTOMOLOGICAL SOCIETY.' (NO COPIES AVAILABLE)
KEYWORDS. SULFUR, VOLUMETRIC ANALYSIS.

*BARR, D. J., AND C. N. SWANSTON. 12 70191
MEASUREMENT OF CREEP IN A SHALLOW, SLIDE-PRONE TILL SOIL.
AMER. J. SCI. 269(12), P. 467-480, ILLUS.
CREEP RATES IN EXCESS OF ONE-FOURTH INCH PER YEAR HAVE BEEN RECORDED AT THE SURFACE OF SHALLOW GLACIAL TILL SOILS IN SOUTHEASTERN ALASKA. THE MEASURED CREEP DECREASES RAPIDLY WITH DEPTH, APPROACHING 0 AT AN IMPERMEABLE LOWER SOIL BOUNDARY. THE SOIL APPARENTLY MOVES AS A FLOW MASS WITH NO WELL-DEFINED SHEAR ZONES.
KEYWORDS. CREEP, CLEARCUTTING, FOREST CUTTING SYSTEMS, CUTTING.

COCHRAN, P. H. 05 71058
PUMICE PARTICLE BRIDGING AND NUTRIENT LEVELS AFFECT LODGEPOLE AND PONDEROSA PINE SEEDLING DEVELOPMENT.
USDA FOREST SERV. RES. NOTE PNW-150, 10 P.
ROOT EXPANSION IN THE C1 HORIZON OF THE LAPINE SOIL IS LIMITED, APPARENTLY, BECAUSE THE GRAVEL-SIZED PUMICE PARTICLES BRIDGE TOGETHER CREATING A BARRIER TO ROOT PENETRATION. THE LOW NUTRIENT CONTENT OF THE C1 HORIZON LIMITED THE SIZE OF THE PONDEROSA PINE SEEDLINGS BUT WAS NOT THE FACTOR RESTRICTING DEPTH OF ROOT PENETRATION FOR EITHER LODGEPOLE OR PONDEROSA PINE SEEDLINGS.
KEYWORDS. SOIL PHYSICS, SOIL CHEMISTRY, ROOT DEVELOPMENT, SOIL NUTRIENTS, SOIL BULK DENSITY, SEEDLINGS, PONDEROSA PINE, LODGEPOLE PINE.

KLOCK, G. O., AND L. BOERSMA*. 01 71048
HARD TO DRAIN SOIL RESPONDS TO PLASTIC TUBING.
CROPS AND SOILS, 1971, P. 23-24. (NO COPIES AVAILABLE)
PERFORATED PLASTIC DRAINAGE PIPES OFFER PROMISE OF REDUCING THE COST PER FOOT OF DRAIN.
KEYWORDS. DRAINAGE, SOIL MOISTURE, PLASTIC PIPE.

PAETH, R. C., M. E. HARWARD, E. G. KNOX*, AND C. T. DYRNESS. 10 71185
FACTORS AFFECTING MASS MOVEMENT OF FOUR SOILS IN THE WESTERN CASCADES OF OREGON.
SOIL SCI. SOC. AMER. PROC., 1971, 35, P. 943-947.
TWO OF THE SOILS DERIVED FROM GREENISH TUFF AND BRECCIA WERE PRONE TO SLOPE FAILURE. THE OTHER TWO SOILS WERE DERIVED FROM YELLOWISH AND REDDISH TUFF AND BRECCIA AND WERE MORE STABLE. STABILITY OF THESE SOILS DID NOT APPEAR TO CORRELATE WITH CLAY CONTENT, CONTENT OF AMORPHOUS CLAY, OR PROPORTIONS OF EXCHANGEABLE CATIONS.
KEYWORDS. SOIL STABILIZATION, SOIL STRUCTURE, SOIL ANALYSIS.

SWANSTON, D. N. 08 71171
PRINCIPAL MASS MOVEMENT PROCESSES INFLUENCED BY LOGGING, ROAD BUILDING, AND FIRE.
FOREST LAND USES AND STREAM ENVIRON. SYMP. PROC. 1970, P. 29-40, ILLUS.
DOMINANT CLASSES OF SOIL MASS MOVEMENT ACTIVE ON WATERSHED SLOPES IN THE WESTERN UNITED STATES ARE IDENTIFIED AND A SIMPLE MOVEMENT MECHANISM DESCRIBED. THE EFFECTS OF LOGGING, ROAD BUILDING, AND FIRE ON MASS MOVEMENT OCCURRENCE ARE ALSO IDENTIFIED AND THEIR IMPORTANCE AS AN EROSION ACCELERATING AGENT EVALUATED.
KEYWORDS. LANDSLIDES, ROAD BUILDING, SOIL EROSION, AVALANCHES, SOIL MOISTURE.

TIEDEMANN, ARTHUR R., AND TOM D. ANDERSON. 08 71108
RAPID ANALYSIS OF TOTAL SULPHUR IN SOIL AND PLANT MATERIAL.
PLANT AND SOIL 35(1), P. 197-200.
THE LECO HIGH FREQUENCY INDUCTION FURNACE TECHNIQUE WAS ADAPTED FOR RAPID TITRIMETRIC ANALYSIS OF TOTAL S IN SOILS AND PLANT MATERIAL. ACCURACY AND PRECISION WERE TESTED.
KEYWORDS. SOIL ANALYSIS, PLANT ANALYSIS, SULPHUR, INDUCTION FURNACE METHOD.

WOOLDRIDGE, DAVID D. 12 70189
CHEMICAL AND PHYSICAL PROPERTIES OF FOREST LITTER LAYERS IN CENTRAL WASHINGTON.
IN 'TREE GROWTH AND FOREST SOILS,' CHESTER T. YOUNGBERG AND CHARLES B. DAVEY (EDS.). THIRD N. AMER. FOREST SOILS CONF. PROC. 1968, P. 327-337.
OBJECTIVES OF THIS STUDY WERE TO DETERMINE PHYSICAL AND CHEMICAL PROPERTIES OF FOREST FLOOR LAYERS, AND COMPARE PROPERTIES OF LAYERS BY SOIL PARENT MATERIALS AND FOREST TYPES--BASALT AND OTHER PARENT MATERIALS, AND PONDEROSA PINE AND MIXED CONIFER FOREST TYPES.
KEYWORDS. FOREST LITTER, FOREST SOILS, SOIL PROPERTIES, ECOSYSTEMS, BASALTS, 'PINUS PONDEROSA,' WASHINGTON (STATE).

SUPPLY AND DEMAND

BOLSINGER, CHARLES L. 05 71049
TIMBER RESOURCES OF THE PUGET SOUND AREA.
USDA FOREST SERV. RESOUR. BULL. PNW-36, 72 P., ILLUS.
THIS REPORT PRESENTS TIMBER RESOURCE STATISTICS FOR THE PUGET SOUND AREA OF WASHINGTON. INCLUDED ARE 40 DETAILED TABLES AND INTERPRETIVE TEXT.
KEYWORDS. FOREST SURVEYS, STAND COMPOSITION, STAND VOLUME, FOREST OWNERSHIP, FOREST STATISTICS, PUGET SOUND, WASH.

DARR, DAVID R. 7 71073
PRODUCTION, PRICES, EMPLOYMENT, AND TRADE IN NORTHWEST FOREST INDUSTRIES, FIRST QUARTER 1971.
PACIFIC NORTHWEST FOREST AND RANGE EXP. STA., 56 P., ILLUS.
PROVIDES CURRENT INFORMATION ON LUMBER AND PLYWOOD PRODUCTION AND PRICES, EMPLOYMENT IN THE FOREST INDUSTRIES, INTERNATIONAL TRADE IN LOGS, LUMBER, AND PLYWOOD, VOLUME AND AVERAGE PRICES OF STUMPAGE SOLD BY PUBLIC AGENCIES, AND OTHER RELATED ITEMS.
KEYWORDS. FORESTRY PRODUCTION ECONOMICS, LUMBER PRICES, PLYWOOD PRICES, LUMBER TRADE, EMPLOYMENT, FOREST INDUSTRIES.

DARR, DAVID R. 9 71100
PRODUCTION, PRICES, EMPLOYMENT, AND TRADE IN NORTHWEST FOREST INDUSTRIES, SECOND QUARTER 1971.
PACIFIC NORTHWEST FOREST AND RANGE EXP. STA., 62 P., ILLUS.
PROVIDES CURRENT INFORMATION ON LUMBER AND PLYWOOD PRODUCTION AND PRICES, EMPLOYMENT IN THE FOREST INDUSTRIES, INTERNATIONAL TRADE IN LOGS, LUMBER, AND PLYWOOD, VOLUME AND AVERAGE PRICES OF STUMPAGE SOLD BY PUBLIC AGENCIES, AND OTHER RELATED ITEMS.
KEYWORDS. FORESTRY BUSINESS ECONOMICS, LUMBER, PLYWOOD, TIMBER VOLUME, STUMPAGE SALES, EMPLOYMENT, MARKETING, LOG EXPORTS.

DARR, DAVID R. 12 71151
PRODUCTION, PRICES, EMPLOYMENT, AND TRADE IN NORTHWEST FOREST INDUSTRIES, THIRD QUARTER 1971.
PACIFIC NORTHWEST FOREST AND RANGE EXP. STA., 54 P., ILLUS.
PROVIDES CURRENT INFORMATION ON LUMBER AND PLYWOOD PRODUCTION AND PRICES, EMPLOYMENT IN THE FOREST INDUSTRIES, INTERNATIONAL TRADE IN LOGS, LUMBER, AND PLYWOOD, VOLUME AND AVERAGE PRICES OF STUMPAGE SOLD BY PUBLIC AGENCIES, AND OTHER RELATED ITEMS.
KEYWORDS. FORESTRY PRODUCTION ECONOMICS, LUMBER PRICES, PLYWOOD PRICES, LUMBER TRADE, EMPLOYMENT, FOREST INDUSTRIES.

DARR, DAVID R. 12 70199
PRODUCTION, PRICES, EMPLOYMENT, AND TRADE IN NORTHWEST FOREST INDUSTRIES, FOURTH QUARTER 1970.
PACIFIC NORTHWEST FOREST AND RANGE EXP. STA., 57 P., ILLUS.
PROVIDES CURRENT INFORMATION ON LUMBER AND PLYWOOD PRODUCTION AND PRICES, EMPLOYMENT IN THE FOREST INDUSTRIES, INTERNATIONAL TRADE IN LOGS, LUMBER, AND PLYWOOD, VOLUME AND AVERAGE PRICES OF STUMPAGE SOLD BY PUBLIC AGENCIES, AND OTHER RELATED ITEMS.
KEYWORDS. FORESTRY PRODUCTION ECONOMICS, LUMBER PRICES, PLYWOOD PRICES, LUMBER TRADE, EMPLOYMENT, FOREST INDUSTRIES.

HAMILTON, THOMAS E. 08 71096
LOG EXPORT POLICY--THEORY VS. REALITY.
J. FOREST. 69, P. 494-497.
THIS PAPER DISCUSSES THE LOCAL, REGIONAL, AND NATIONAL IMPACTS WHICH MUST BE CONSIDERED IN FORMULATING A LOG EXPORT POLICY.
KEYWORDS. FOREIGN TRADE, LOG EXPORTS, ECONOMIC POLICY.

WALL, BRIAN R. 7 71089
1970 OREGON TIMBER HARVEST.
USDA FOREST SERV. RESOURCE BULL. PNW-38, 2 P., ILLUS.
CHRONICLES TIMBER HARVEST FOR 1950-1970 AND GIVES DETAIL BY COUNTIES FOR 1970.
KEYWORDS. TIMBER STATISTICS.

WALL, BRIAN R. 05 71074
1970 WASHINGTON TIMBER HARVEST.
USDA FOREST SERV. RESOURCE BULL. PNW-37, 2 P., ILLUS.
CHRONICLES TIMBER HARVEST FOR 1950-1970 AND GIVES DETAIL BY COUNTIES FOR 1970.
KEYWORDS. TIMBER STATISTICS.

TIMBER MANAGEMENT

BARRETT, JAMES W. 12 71157
PONDEROSA PINE GROWTH AND STAND MANAGEMENT.
IN 'PRECOMMERCIAL THINNING OF COASTAL AND INTERMOUNTAIN FORESTS IN THE PACIFIC NORTHWEST,' WASH. STATE UNIV., P. 5-9, ILLUS.
RECENT STUDIES IN NATURAL, UNTHINNED STANDS THAT HAVE GROWN AT UNUSUALLY LOW DENSITIES SUGGEST THAT 140 TREES PER ACRE CAN PRODUCE AS MUCH OR MORE USABLE WOOD AT AGE 45 AS 420 TREES PER ACRE.
KEYWORDS. THINNING (TREES), STAND DENSITY, PONDEROSA PINE, BRUSH CONTROL.

DAHMS, WALTER G. 02 71045
FIFTY-FIVE-YEAR-OLD LODGEPOLE PINE RESPONDS TO THINNING.
USDA FOREST SERV. RES. NOTE PNW-141, 13 P., ILLUS.
DIAMETER GROWTH OF 55-YEAR-OLD LODGEPOLE PINE TREES RELEASED BY THINNING WAS SUBSTANTIALLY GREATER THAN

UNRELEASED TREES IN RELATIVE TERMS. PRESUMED RELEASE EFFECT WAS SUFFICIENT TO PREVENT A SIGNIFICANT VOLUME INCREMENT LOSS ON THINNED PLOTS. HOWEVER, ABSOLUTE DIAMETER GROWTH WAS SMALL BECAUSE DIAMETER GROWTH CAPABILITY OF 55-YEAR-OLD LODGEPOLE PINE TREES IS LIMITED.
KEYWORDS. FOREST THINNING, 'PINUS CONTORTA,' LODGEPOLE PINE, TREE GROWTH, STAND INCREMENT ESTIMATES, TREE DISEASES, PRINGLE FALLS EXPERIMENT FOREST, OREG.

DAHMS, WALTER G. 12 71158
GROWTH RESPONSE IN LODGEPOLE PINE FOLLOWING PRECOMMERCIAL THINNING.
IN 'PRECOMMERCIAL THINNING OF COASTAL AND INTERMOUNTAIN FORESTS IN THE PACIFIC NORTHWEST,' WASH. STATE UNIV., P. 14-18, ILLUS.
LODGEPOLE PINE TREES RESPOND WELL TO THINNING. YOUNG TREES RESPOND BETTER THAN OLD ONES, AND TREES GROWING ON GOOD SITES RESPOND BETTER THAN THOSE GROWING ON POOR SITES. THERE IS SOME EVIDENCE THAT BADLY STAGNATED TREES OR THOSE OF THE LOWER CROWN CLASSES DO NOT ALWAYS RESPOND.
KEYWORDS. THINNING (TREES), STAND DENSITY, LODGEPOLE PINE.

FARR, WILBUR A., AND A. S. HARRIS. 12 71193
PARTIAL CUTTING OF WESTERN HEMLOCK AND SITKA SPRUCE IN SOUTHEAST ALASKA.
USDA FOREST SERV. RES. PAP. PNW-124, 10 P., ILLUS.
IN THIS CASE STUDY OF 96-YEAR-OLD STANDS, DIAMETER GROWTH RESPONDED TO THINNING, EPICORMIC BRANCHING ON SPRUCE WAS STIMULATED, AND CUT PLOTS BECAME WELL STOCKED WITH NATURAL REGENERATION.
KEYWORDS. THINNING, ROTATION AGE, WESTERN HEMLOCK, 'TSUGA HETEROPHYLLA,' SITKA SPRUCE, 'PICEA SITCHENSIS.'

FRANKLIN, JERRY F. 12 71197
SOME IMPRESSIONS OF NATIONAL FOREST MANAGEMENT IN SUBALPINE AREAS OF CENTRAL HONSHU, JAPAN. (IN JAPANESE.)
RINGYO GIJYUTSU 350, P. 9-13. (NO COPIES AVAILABLE)
DISCUSSION OF FOREST MANAGEMENT PROBLEMS IN THE SUBALPINE FORESTS OF CENTRAL HONSHU, JAPAN WITH RECOMMENDATIONS FOR RESEARCH AND CHANGES IN SILVICULTURAL PRACTICES.
KEYWORDS. SUBALPINE FORESTS, JAPANESE FORESTRY, TRUE FIRS, 'ABIES VEITCHII AND MARIESII,' HEMLOCK, 'TSUGA DIVERSIFOLIA,' JAPANESE LARCH, 'LARIX LEPTOLEPIS,' SILVICULTURE, MONOCULTURE, CLEARCUTTING.

HARRIS, A. S. 06 71064
EXPERIENCE WITH DOUGLAS-FIR IN SOUTHEAST ALASKA.
NORTHWEST SCI. 45(2), P. 87-93, ILLUS.
DESCRIBES GROWTH OF DOUGLAS-FIR PLANTED FROM 130-220 MILES NORTH OF ITS NATURAL RANGE ON THE COAST. THE EXCELLENT GROWTH OBSERVED SUGGESTS THAT THE SPECIES MAY HAVE FUTURE SILVICULTURAL VALUE IN SOUTHEAST ALASKA.
KEYWORDS. DOUGLAS-FIR, 'PSEUDOTSUGA MENZIESII,' SILVICULTURE, FOREST SEED PLANTINGS, ALASKA.

MILLER, RICHARD E. 12 71159
THE FUTURE OF PRECOMMERCIAL THINNING.
IN 'PRECOMMERCIAL THINNING OF COASTAL AND INTERMOUNTAIN FORESTS IN THE PACIFIC NORTHWEST,' WASH. STATE UNIV., P. 105-106.
THE NEED FOR GREATER WOOD PRODUCTION IS EVIDENT. THIS PRODUCTION CAN BE MET, IN PART, THROUGH PRECOMMERCIAL THINNING. THE PRESCRIBED, INTELLIGENT USE OF FERTILIZERS ALONE OR ESPECIALLY IN COMBINATION WITH THINNING IS ANOTHER COMPATIBLE AND EFFECTIVE MEANS FOR INCREASING FOREST PRODUCTION.
KEYWORDS. THINNING (TREES), FERTILIZERS, FOREST MANAGEMENT.

MINORE, DON, AND CLARK E. SMITH. 08 71123
OCCURRENCE AND GROWTH OF FOUR NORTHWESTERN TREE SPECIES OVER SHALLOW WATER TABLES.
USDA FOREST SERV. RES. NOTE PNW-160, 9 P., ILLUS.
RED ALDER AND WESTERN REDCEDAR GROW WELL IN SKUNK-CABBAGE AREAS WHERE AVERAGE WINTER WATER TABLES ARE LESS THAN 15 CENTIMETERS DEEP AND STAGNANT. ALDER AND SITKA SPRUCE ALSO GROW WELL WHERE THESE SHALLOW WATER TABLES ARE FLOWING. WESTERN HEMLOCK IS INTOLERANT OF WATER TABLES LESS THAN 15 CENTIMETERS DEEP.
KEYWORDS. WATER-TABLE, FOREST MANAGEMENT, WESTERN HEMLOCK, RED ALDER, WESTERN REDCEDAR, SITKA SPRUCE, DOUGLAS-FIR.

SEIDEL, K. W. 09 71134
GROWTH OF YOUNG EVEN-AGED WESTERN LARCH STANDS AFTER THINNING IN EASTERN OREGON.
USDA FOREST SERV. RES. NOTE PNW-165, 12 P., ILLUS.
RESULTS OF A LEVELS-OF-GROWING-STOCK STUDY IN A 33-YEAR-OLD WESTERN LARCH STAND IN EASTERN OREGON SHOWED 5-YEAR DIAMETER GROWTH INCREASED SHARPLY AS DENSITY DECREASED, WHILE HEIGHT GROWTH WAS NOT AFFECTED BY STOCKING. VOLUME INCREMENT WAS REDUCED AT THE LOWEST DENSITIES, BUT THERE WAS A CONSIDERABLE TRANSFER OF GROWTH FROM MANY SLOW-GROWING TREES TO FEWER FASTER GROWING ONES.
KEYWORDS. STAND DENSITY, THINNING (TREES), FOREST MEASUREMENT, STAND INCREMENT ESTIMATES, WESTERN LARCH, 'LARIX OCCIDENTALIS.'

WILLIAMSON, RICHARD L., AND FRANK E. PRICE*. 08 71087
INITIAL THINNING EFFECTS IN 70- TO 150-YEAR-OLD DOUGLAS-FIR-WESTERN OREGON AND WASHINGTON.
USDA FOREST SERV. RES. PAP. PNW-117, 15 P., ILLUS.
IMMEDIATE HARVESTS IN THE FORM OF THINNINGS WERE ANALYZED ON NINE STUDY AREAS IN VIGOROUS, MATURE STANDS RANGING FROM 70 TO 150 YEARS OLD WHEN THINNED. SUGGESTS THAT SPACING IS IMPORTANT IN VIGOROUS, MATURE STANDS AS WELL AS IN YOUNGER ONES.
KEYWORDS. THINNING (TREES), FOREST CUTTING SYSTEMS, DOUGLAS-FIR, 'PSEUDOTSUGA MENZIESII,' FOREST IMPROVEMENT CUTTING.

WILLIAMSON, RICHARD L., AND GEORGE R. STAEBLER*. 05 71053
COOPERATIVE LEVELS-OF-GROWING STOCK STUDY IN DOUGLAS-FIR. REPORT NO. 1--DESCRIPTION OF STUDY AND EXISTING STUDY AREAS.
USDA FOREST SERV. RES. PAP. PNW-111, 12 P., ILLUS.
THINNING REGIMES IN YOUNG DOUGLAS-FIR STANDS ARE DESCRIBED. SOME CHARACTERISTICS OF INDIVIDUAL STUDY AREAS ESTABLISHED BY COOPERATING PUBLIC AND PRIVATE AGENCIES ARE DISCUSSED.
KEYWORDS. THINNINGS, STAND GROWTH, DOUGLAS-FIR.

WATER QUALITY

BROWN, GEORGE W., GERALD W. SWANK, AND JACK ROTHACHER. 9 71101
WATER TEMPERATURE IN THE STEAMBOAT DRAINAGE.
USDA FOREST SERV. RES. PAP. PNW-119, 17 P., ILLUS.
STREAM TEMPERATURES WERE STUDIED IN A DRAINAGE IN WHICH LOGGING OPERATIONS WERE TYPICAL OF MUCH OF THE COMMERCIAL FORESTS ON THE WEST SLOPES OF THE CASCADE RANGE. CHANGES IN WATER TEMPERATURE OF TRIBUTARY STREAMS INFLUENCED BY VARIOUS DEGREES OF EXPOSURE FROM LOGGING WERE MEASURED, AND A SIMPLIFIED PREDICTION EQUATION WAS TESTED.
KEYWORDS. TEMPERATURE, WATERSHED MANAGEMENT, LOGGING.

FREDRIKSEN, R. L. 08 71174
COMPARATIVE CHEMICAL WATER QUALITY--NATURAL AND DISTURBED STREAMS FOLLOWING LOGGING AND SLASH BURNING.
FOREST LAND USES AND STREAM ENVIRON. SYMP. PROC. 1970, P. 125-137, ILLUS.
FOLLOWING TIMBER HARVEST ON A WATERSHED, LOSS OF NUTRIENTS INCREASED 1.6 TO 3.0 TIMES. DETAILS OF CHEMICALS AND RATE OF LOSS ARE GIVEN.
KEYWORDS. WATERSHED MANAGEMENT, STREAMS, ECOSYSTEM, LOGGING, SLASH DISPOSAL, FOREST CLEARCUTTING.

MEEHAN, WILLIAM R. 04 71030
EFFECTS OF GRAVEL CLEANING ON BOTTOM ORGANISMS IN THREE SOUTHEAST ALASKA STREAMS.
PROG. FISH-CULT. 33, P. 107-111, ILLUS.
SECTIONS OF STREAMBED IN THREE SOUTHEAST ALASKA STREAMS WERE CLEANED BY MEANS OF A MECHANICAL 'RIFFLE SIFTER.' RESULTS INDICATE THAT INVERTEBRATE POPULATIONS WERE REDUCED AS A RESULT OF CLEANING, BUT THAT THEY RETURNED TO PRETREATMENT LEVELS OF ABUNDANCE WITHIN A YEAR AFTER GRAVEL CLEANING.
KEYWORDS. STREAMS, SEDIMENTATION, WILDLIFE MANAGEMENT, SALMON.

NORRIS, LOGAN A., AND MOORE, DUANE G. 08 71172
THE ENTRY AND FATE OF FOREST CHEMICALS IN STREAMS.
FOREST LAND USES AND STREAM ENVIRON. SYMP. PROC. 1970, P. 139-158, ILLUS.
INITIAL DISTRIBUTION OF AERIALLY APPLIED FOREST CHEMICALS, MECHANISMS OF THEIR ENTRY INTO, AND THEIR FATE IN THE AQUATIC ENVIRONMENT ARE CONSIDERED. RESEARCH FINDINGS AND LONG HISTORY OF USE HAVE ESTABLISHED THAT MOST FOREST CHEMICALS OFFER MINIMUM POTENTIAL FOR POLLUTION OF THE AQUATIC ENVIRONMENT WHEN THEY ARE USED PROPERLY.
KEYWORDS. PESTICIDE RESIDUES, STREAMS, ENVIRONMENT, ECOLOGY.

WILDLIFE AND TIMBER

CROUCH, GLENN L. 04 71034
POCKET GOPHERS--ANOTHER HURDLE FOR REFORESTATION IN THE PACIFIC NORTHWEST. (ABSTR.)
IN 'ABSTRACTS OF THE 1971 JOINT MEETINGS OF IDAHO ACADEMY OF SCIENCE-NORTHWEST SCIENTIFIC ASSOCIATION-WASHINGTON STATE ENTOMOLOGICAL SOCIETY.' (NO COPIES AVAILABLE)
KEYWORDS. GOPHERS, REFORESTATION.

CROUCH, GLENN L. 12 71147
SUSCEPTIBILITY OF PONDEROSA, JEFFREY, AND LODGEPOLE PINES TO POCKET GOPHERS.
NORTHWEST SCI. 45(4), P. 252-256, ILLUS.
POCKET GOPHERS DESTROYED TWO-THIRDS OF AN EXPERIMENTAL PLANTING OF PONDEROSA, JEFFREY, AND LODGEPOLE PINES WITHIN 3 YEARS. LOSSES AMONG SPECIES WERE NEARLY IDENTICAL WHICH APPEARS TO NEGATE PLANTING ONE OF THE SPECIES INSTEAD OF ANOTHER TO REDUCE PREDATION. MORE THAN 80 PERCENT OF THE MORTALITY ATTRIBUTED TO GOPHERS OCCURRED DURING THE WINTER.
KEYWORDS. POCKET GOPHERS, PONDEROSA PINE, LODGEPOLE PINE, JEFFREY PINES, WILDLIFE MANAGEMENT.

DIMOCK, EDWARD J., II. 06 71063
INFLUENCE OF DOUGLAS-FIR SEEDLING HEIGHT ON BROWSING BY BLACK-TAILED DEER.
NORTHWEST SCI. 45(2), P. 80-86, ILLUS.
A PILOT TEST UNDER CONTROLLED CONDITIONS WAS MADE WITH SEEDLINGS FROM FIVE WIDELY SEPARATED WESTERN WASHINGTON PROVENANCES. THOUGH BROWSING MARKEDLY DIFFERED BETWEEN SOURCES, FURTHER TESTING AND ANALYSIS SHOWED THAT PREFERENCES WERE STRONGLY LINKED TO SMALL VARIATIONS IN SEEDLING HEIGHT--INDEPENDENT OF SEED ORIGIN.
KEYWORDS. DEER, BROWSE, SEEDLING, DOUGLAS-FIR, 'PSEUDOTSUGA MENZIESII.'

WOOD UTILIZATION

*ANDERSON, L. O., T. B. HEEBINK, AND A. E. CVIATT. 12 71192
CONSTRUCTION GUIDES FOR EXPOSED WOOD DECKS.
PAC. NORTHWEST FOREST AND RANGE EXP. STN., 78 P., ILLUS.
OFFERS GUIDES TO THE DESIGN, FINISHING, AND TREATMENT OF OUTDOOR WOOD DECKS TO INSURE USER SATISFACTION. BOTH GOOD AND POOR CONSTRUCTION DETAILS ARE AMPLY ILLUSTRATED FOR THE BENEFIT OF ARCHITECTS, BUILDERS, AND HOMEOWNERS.
KEYWORDS. HOUSING, CONSTRUCTION MATERIALS, CONSTRUCTION, FOREST PRODUCTS.

GRANTHAM, JOHN B. 06 71075
AIRBORNE-NOISE CONTROL IN LIGHTWEIGHT FLOOR-CEILING SYSTEMS.
SOUND AND VIBRATION 5(6), P. 12-16, ILLUS.
FIELD MEASUREMENTS IN SIX SEATTLE BUILDINGS SHOW THAT A COMBINATION OF CELLULAR CONCRETE AND RESILIENT CHANNELS GREATLY IMPROVES THE INSULATION OF WOOD FRAME FLOORS AGAINST AIRBORNE-NOISE TRANSMISSION.
KEYWORDS. ACOUSTICS, INSULATION, CONSTRUCTION MATERIALS, CONCRETE CONSTRUCTION.

GRANTHAM, J. B., AND T. B. HEEBINK. 05 71047
FIELD MEASURED SOUND INSULATION OF WOOD-FRAMED FLOORS.
FOREST PROD. J. 21(5), P. 33-38, ILLUS.
THE SOUND INSULATING CHARACTERISTICS OF THREE GENERAL TYPES OF WOOD-FRAMED FLOOR SYSTEMS WERE MEASURED IN 10 SEATTLE BUILDINGS. FIELD MEASUREMENTS AGREED WELL WITH VALUES DETERMINED IN LABORATORY TESTS OF SIMILAR FLOOR SYSTEMS.
KEYWORDS. ACOUSTIC INSULATION, FLOORS, INSULATION, STRUCTURAL PROPERTIES (WOOD).

HEEBINK, T. B., AND J. B. GRANTHAM. 10 71175
FIELD/LABORATORY STC RATINGS OF WOOD-FRAMED PARTITIONS.
SOUND AND VIB. 5, P. 12-16, ILLUS.
THIRTY-ONE FIELD EVALUATIONS OF THE SOUND ATTENUATION PROVIDED BY WOOD-FRAMED PARTY WALLS AND FLOORS SHOW REMARKABLE AGREEMENT WITH PUBLISHED LABORATORY RATINGS.
KEYWORDS. ACOUSTIC INSULATION, WOOD-FRAME CONSTRUCTION.

LANE, PAUL H. 06 71062
IDENTIFYING VENEER IN RECOVERY STUDIES.
FOREST PROD. J. 21(6), P. 32-33, ILLUS.
VENEER RECOVERY CAN BE DETERMINED ON AN INDIVIDUAL PEELER BLOCK BASIS, BY A SIMPLE COLOR CODING SYSTEM. PAINT OR DYE SPRAY NOZZLES ARE USED TO STRIPE THE GREEN VENEER WITH AN IDENTIFYING COLOR CODE. AN UNLIMITED NUMBER OF BLOCKS CAN BE STUDIED.
KEYWORDS. VENEERS, FOREST PRODUCTS.

*MANOCK, EUGENE R., GROVER A. CHOATE , AND DONALD R.GEDNEY. 12 70192
OREGON TIMBER INDUSTRIES, 1968--WOOD CONSUMPTION AND MILL CHARACTERISTICS.
STATE OREG. DEP. FOREST. AND PAC. NORTHWEST FOREST AND RANGE EXP. STA. USDA FOREST SERV., 122 P., ILLUS.
REPORT PRESENTS A SET OF COMPREHENSIVE STATISTICS ON WOOD CONSUMPTION AND CHARACTERISTICS OF PRIMARY WOOD PROCESSING MILLS AND PLANTS IN THE STATE OF OREGON FOR THE YEAR 1968.
KEYWORDS. WOOD-USING INDUSTRIES, TIMBER STATISTICS, LUMBER SUPPLY, FOREST INDUSTRIES, WOOD WASTE, FORESTRY BUSINESS ECONOMICS, LOG EXPORTS, OREGON.

PLANK, MARLIN E. 11 71170
RED ALDER.
U.S. DEP. AGR. AMER. WOODS--FS-215, 7 P., ILLUS.
A NONTECHNICAL DESCRIPTION OF THE DISTRIBUTION, CHARACTERISTICS, AND USES OF THE TREE AND ITS WOOD.
KEYWORDS. RED ALDER, WOOD PROPERTIES, FOREST INDUSTRIES.

PONG, W. Y. 7 71098
CHANGES IN GRADE AND VOLUME OF CENTRAL CALIFORNIA WHITE FIR LUMBER DURING DRYING AND SURFACING.
USDA FOREST SERV. RES. NOTE PNW-156, 20 P., ILLUS.
LUMBER FROM 20 WHITE FIR TREES, TOTALING OVER 43,000 BOARD FEET, WAS CAREFULLY GRADED IN THE ROUGH GREEN, ROUGH DRY, AND SURFACED DRY CONDITION. GRADE AND VOLUME CHANGES OCCURRING AFTER EACH STAGE IN PROCESSING WERE RECORDED AND ANALYZED.
KEYWORDS. LUMBER SEASONING, WOOD QUALITY, LUMBER, WHITE FIR.

SCHEFFER, THEODORE C., ARTHUR F. VERRAL, AND GEORGE HARVEY. 09 71127
FIFTEEN-YEAR APPRAISAL OF DIP TREATING FOR PROTECTING EXTERIOR WOODWORK--EFFECTIVENESS ON DIFFERENT WOOD SPECIES AND IN VARIOUS CLIMATES.
MATER. UND ORGANISMEN, 1971, P. 27-44, ILLUS. (NO COPIES AVAILABLE)
FOR EXPOSED WOOD IN SERVICE ABOVE THE GROUND, DIP TREATING OF THE PRECUT LUMBER IS DISTINCTLY WORTHWHILE ON A VARIETY OF SOFTWOODS IN DIVERSE CLIMATES. DIP TREATMENT SHOULD NOT BE RELIED UPON FOR VALUABLE PERMANENT STRUCTURES SUBJECT TO SEVERE RAIN WETTING--SUCH A CONDITION REQUIRES PRESSURE-TREATED WOOD.
KEYWORDS. LUMBER PRESERVATION, FOREST PRODUCTS RESEARCH.

*WILCOX, W. WAYNE, AND W. Y. PONG. 08 71115
THE EFFECTS OF HEIGHT, RADIAL POSITION, AND WETWOOD ON WHITE FIR WOOD PROPERTIES.
WOOD AND FIBER 3(1), P. 47-55.
THIS STUDY SUMMARIZES A STUDY OF BOARDS SAWN AND IDENTIFIED WITH TREE, HEIGHT ABOVE GROUND, AND RADIAL POSITION WITHIN THE STEM.
KEYWORDS. WHITE FIR, 'ABIES CONCOLOR,' WOOD PROPERTIES, WETWOOD.

WOODFIN, RICHARD O., JR., AND PAUL H. LANE. 09 71122
VENEER YIELD BY LOG GRADE AND SIZE FROM BLACK HILLS PONDEROSA PINE.
USDA FOREST SERV. RES. NOTE PNW-164, 7 P., ILLUS.
VENEER GRADE RECOVERY BY LOG DIAMETER CLASS AND LOG GRADE FOR PONDEROSA PINE IS PRESENTED FROM 236 BLACK HILLS PONDEROSA PINE LOGS. LOG DIAMETERS RANGED FROM 7 TO 18 INCHES. AVERAGE VENEER RECOVERY WAS 3 PERCENT IN GRADES A AND B, 44 PERCENT IN GRADE C, AND 53 PERCENT IN GRADE D.
KEYWORDS. VENEER LOGS, PONDEROSA PINE.

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